THE IRON TRADE REVIEW

XXX. CLEVELAND, O. JANUARY 7, 1897. CHICAGO, ILL. NUMBE

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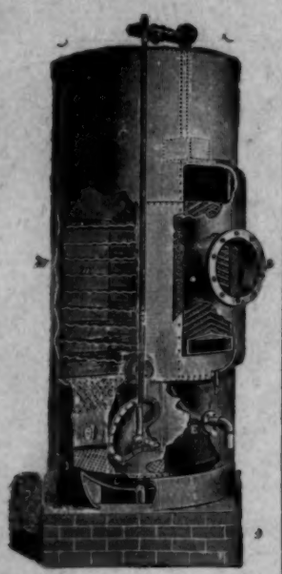

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THE IRON TRADE REVIEW

VOLUME XXX. CLEVELAND, O. JANUARY 7, 1897. CHICAGO, ILL. NUMBER 1.

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

A feeling of uncertainty as to the basis of values in the first half of 1897 dominates the iron trade today. More or less uneasiness is evident, growing out of the general belief that producers who expect to get their accustomed share of business must be prepared to come close to the pace that is to be set by the leading interest at Pittsburg. The problem is the attainment of a Bessemer ore mixture that shall approximate the new Duquesne standard of five cents a unit, and ways of safely increasing the percentage of Mesabi ores will be studied in new earnest. The Pittsburg market especially has shown the symptoms that attend transition periods. Prices are unsettled and there is more than the usual variation between the highest and lowest. While buyers talk of $10 iron at valley furnace, and one exceptionally low sale is reported, it does not appear that in other cases furnaces are quoting below $10.50, valley. Yet reports of transactions even below the $10 mark are persistent. It is difficult to tell how much of the weakness is due to the necessity of realizing on accumulated iron, how much to the uneasiness of middlemen caused by the usual holiday weakness and the contagion of low-cost talk, and how much to the fact that furnacemen are getting in shape to make cheaper iron if it must come. It need not be expected that the selling of iron below cost will keep up long, especially in view of the widespread belief that 1897 will bring a trade revival. The market for Bessemer steel continues to show the wide range in values noted last week. There are reports of sales below $15, and some steel for shipment west of Pittsburg has netted from $14.75 and $14.85 at mill. Some makers insist that $16, Pittsburg, is their minimum and are not attempting to compete for business that involves a loss. So much steel has been disposed of in the past three weeks that the movement for a new pool basis encounters great difficulties. The committee is still at work, but the manufacturers' meeting appointed for this week has been postponed to the latter part of the month. The finished material market has scarcely made a start in the new year, and the uncertainties about primary products are not conducive to free contracting. A Central Pennsylvania bridge calling for 10,000 tons of material is the largest job in sight, but developments in building are promised as soon as the financing of such enterprises becomes clearer. That car building in 1896 should have come up to a total of 51,000 against 38,000 in 1895 is a surprise, in view of the little impression made by this business on the iron trade. Bar mills are looking, with reason, for better demand in 1897 from both railroad and agricultural sources, the improved buying ability of the agricultural community being one of the most hopeful elements in the outlook. All the unsettling tendencies that appear to-day within the iron trade will be counteracted, if at all, from without. If the general hopes and predictions for all industry in 1897 are measurably realized, the necessity for getting down to the lowest possibilities of cost will be removed. In any event demand promises to be a much larger factor in fixing prices in 1897 than it was allowed to be in the year just closed.

THE CLEVELAND DISTRICT.

In the absence of any action about ore prices or ore output in 1897, or any likelihood of such action for some weeks to come, and with conditions such that very few sales of dock ore are to be expected this winter, the relation of current movements in pig iron and steel to the primary interest is the uppermost subject from an ore standpoint. It is recognized that one interest in the iron trade will not be allowed to enjoy exceptional advantages, and that competitors may be depended upon to find ways of approximating, at least, the low costs recently talked about. A steel works, for example, with a mining connection on the Marquette or Menominee range, would be able under its lower lake and rail freights, to get a price, on dock at Lake Erie, as cheap as that of the average Mesabi ore delivered there. And when the ore rate over the new "Bessemer" road to Homestead is officially published, as it will be, under the Inter-State Commerce act, other lines will know just what they will have to meet in order to put their furnacemen customers in shape to compete. As to the probability of a Bessemer ore agreement in 1897, the situation is far from clear. Should there be one, it will doubtless differ in a number of particulars from that of 1896.

Pig Iron. It is evident from current reports from the valleys that cost has been lost sight of in connection with the Bessemer iron market. Offers of $10, at furnace, continue to be made, but so far as local firms are concerned these are refused, and it is stated that in one of the large transactions referred to a week ago, involving deliveries in the second quarter of the year none of the iron went at less than $10.50. There are some reports by way of Pittsburg indicating lower than $10 iron at furnace, but they cannot be duplicated in this market. Foundry iron and gray forge are exceedingly quiet. The former is weaker, in sympathy with the feeling in Bessemer, but quotations have not changed, in the absence of figuring:

Bessemer	$11 15@11 40	Valley Scotch No. 1	$11 65@12 15
No. 1 Strong Foundry	11 65@12 00	Valley Scotch No. 2	11 15@11 40
No. 2 Strong Foundry	11 25@11 50	Gray Forge	9 65@9 90
No. 3 Foundry	10 75@11 00	Lake Superior Charcoal	13 50

Finished Material. The price of steel seems to be of more interest to consumers of mill products than prices of rolled material, since demand for the latter waits on a more settled condition in the former. No local billet sales are reported in the week, but buyers' ideas are about $16, delivered, which few mills will entertain. The chief change in finished material is a reduction of $3 a ton on hoops and bands. The bar iron manufacturers have made no change in their 1.15c Cleveland price, but an early meeting is to consider the subject. Steel bars are still on a 1c basis, Pittsburg. Sheets are lower and on average lots 2c to 2.05c for No. 27 is the basis. An inquiry for vessel material from another lake port has come up, but bridge and architectural lines are very quiet. Old material is weaker. No. 1 railroad wrought scrap is quoted $11, mill scrap, $8; wrought turnings, $7.50; cast borings, $5; old iron rails, $14.50; old car wheels, $11.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1142 MONADNOCK BLOCK, Jan. 6.

The year did not start in the most encouraging way, but this is only what might have been expected from the indications of the last week of the old year. Sales of all classes of material have been small and the demand is extremely light. In pig iron almost no business was closed last week and very little is in prospect. Steel of all kinds is in light demand and the market is much inclined to be weak. Altogether the present conditions of the iron and steel market is not at all encouraging. Dealers have been looking forward to a considerable increase in the demand by the middle of this month, and this may yet come, but it does not seem likely that any marked improvement will come before the first of February. Producers of all kinds of manufactured articles report a small demand for their goods, and this naturally makes a small consumption of the materials entering into them. Concerns having agencies in Chicago and also in the East report that their Eastern offices are getting by far the better end of the business.

PIG IRON.—Last week was quiet and sales were few and small. The inquiries in hand do not indicate that business will improve to any great extent in the immediate future, but dealers are hoping that before the first of February there will be a turn in affairs and they will be doing at least a moderately good business. One inquiry of 1,000 tons is in the market and has been received by every dealer in this territory. This is the only business of any size that has come up in the last two weeks or that is in sight at present. It is a question whether even this will be placed. In the absence of any transaction it is difficult to make quotations, but it may be said that while the prices we give fairly represent the market on recent business, Southern furnaces, at least, would be willing to accept lower prices if anything worth while were to come up.

Lake Sup. Charcoal	$13 50@14 00	Southern No. 2 Soft	$10 90@11 40
Local Coke Fdy. No. 1	11 75@12 25	South'n Silveries No. 1	12 15@12 65
Local Coke Fdy. No. 2	11 25@11 75	South'n Silveries No. 2	11 65@12 15
Local Coke Fdy. No. 3	11 00@11 25	Jackson Co. Silveries	14 00@16 05
Local Scotch Fdy. No. 1	11 75@12 25	Ohio Silveries No. 1	15 00@15 55
Local Scotch Fdy. No. 2	11 25@11 75	Ohio Silveries No. 2	14 50@15 05
Local Scotch Fdy. No. 3	11 00@11 25	Ohio Strong Softeners	14 00@14 28
South'n Coke No. 1	11 65@11 90	Alabama Car Wheel	16 65@17 15
South'n Coke No. 2	11 15@11 40	Malleable Bessemer	12 75@13 50
South'n Coke No. 3	10 90@11 40	Coke Bessemer	13 00@13 50
Southern No. 1 Soft	11 15@11 40		

BAR IRON.—The demand has been small and orders even smaller. There is no prospect of an immediate betterment of the situation, as no buyers have shown a desire to make purchases. Quotations are made as follows: Common iron, 1.25c to 1.30c; soft steel bars from strictly billet stock, 1.20c to 1.30c.

RAILS AND TRACK SUPPLIES.—The only order of any consequence taken by the local steel company was its share of the business placed by the Pennsylvania Co. Some of the Western railroads are expected to place considerable business in the near future, but so far they have not come to the front. Prices are made: Rails, $26; splice bars, 1.40c to 1.45c; track bolts with square nuts, 1.95c to 2c; hexagon nuts, 2.05c to 2.10c; spikes, 1.65c to 1.75c.

BILLETS AND RODS.—Nothing is being done in the market in either billets or rods except in a small way. In the absence of transactions no quotations are made on billets, but rods are quoted from $24 to $25, according to specifications.

STRUCTURAL MATERIAL.—No new business came up in this market last week and no contracts of any size were placed. There is nothing in sight and the outlook is decidedly not encouraging. It is hoped that plans for new construction will materialize with the opening of the spring. Quotations are as follows: Beams and channels, 1.73c to 1.80c; angles, 1.25c to 1.30c; plates, 1.25c to 1.30c; tees, 1.50c to 1.55c. Small lots from stock are quoted ¼c to ½c higher.

PLATES.—One order of 500 tons of plates were taken last week by the local steel company to go to Duluth, and several orders of considerably smaller tonnage. The inquiry is very light and no large business is looked for in the immediate future. Prices are inclined to be weak, and quotations are made as follows: Tank steel, 1.25c to 1.30c; flange steel, 1.45c to 1.55c; fire-box, 2c to 5c.

SHEETS.—There was some little business placed last week in galvalnized sheets, but general conditions are not very much better, if at all, than they were a week ago. The inquiry is light and sales are only small. Quotations are weak at 2.20c to 2.25c, for No. 27 black and 80 to 80 2½ per cent discount for galvanized.

MERCHANT STEEL.—Almost no business was done last week and not much is expected for the next week or ten days. Prices are as follows: Open-hearth spring, tire and machinery steel, 1.85c to 1.95c; smooth finished machinery steel, 1.60c to 1.65c; smooth finished tire, 1.55c to 1.65c; tool steel, 5.50c to 7.50c; specials, 11c and upwards.

OLD MATERIAL.—A sale of 500 tons of steel punchings and shearings is the only one of consequence made last week. The demand is very light and is not expected to be better right away. In the absence of transactions, prices are only nominal. Quotations are made at $13 and $14 for old iron rails; $10 to $11 for old steel rails, and $11.75 to $12.50 for old wheels. Miscellaneous scrap is quoted about as follows: Railroad forge, $11.50 to $12; dealer's forge, $10.75 to $11.25; No. 1 mill, $8; heavy cast, $8 to $8.50; malleable cast, $8 to $9.50; axles, $14.75; cast borings, $4; wrought turnings, $5.50; axle turnings, $6 to $6.50; mixed steel, $7.50; stove plates, $5.75; heavy melting steel, $9.25 to $9.75.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
807 TRADESMEN'S BUILDING, Jan. 6.

In Bessemer pig iron and billets—the only lines at all active—conditions are so tangled and uncertain as to puzzle buyers completely. Excitement in steel circles is unabated, while Bessemer iron now shows a like condition. What or how much business is being done in these two products cannot be told definitely. It is very certain, however, that no other part of the market shows any life whatever excepting, perhaps, black sheets. The quiet conditions in finished material are offset in part by indications of prospective work in various parts of the country, upon which mills expect soon to figure.

PIG IRON.—Conditions in Bessemer iron are perplexing in the extreme. Uncertainty is prevalent everywhere, and rumors of sales, trading deals and options with attendant conditions are mingled with reports exactly counter. Local furnacemen and brokers deny emphatically that sales are current at or below $10.65, Pittsburg; while, on the other hand, a sale of 10,000 tons is reported on unquestionable authority at $10.40, Pittsburg. This figure in this single transaction resulted from the necessity of realizing on the iron at once, and is not referred to as representing the market. Gossip regarding ore matters has not in the least subsided, and if current report can be depended on furnacemen have in view changes of mixtures that will use larger percentages of the less expensive ores. The fear of lower markets is everywhere in evidence, and with more timid sellers has caused somewhat of a panic, resulting in some very low figures on contracts running through half of this year. Speculative holders of iron have been particularly excited and considerable metal of this sort has been put upon the market. Furnacemen generally are in suspense, not knowing exactly what turn the market may take. Contingencies are being provided for, and more definite movements can be expected before the end of the quarter. Gray forge iron is slightly weaker than at last report and in little demand. Foundry irons are unchanged and lifeless. A few lots of special irons are reported closed during the week. We quote:

Bessemer	$10.75 to $10.90
No. 1 Foundry	11.50 to 12.00
No. 2 Foundry	11.00 to 11.25
No. 3 Foundry	10.50 to 10.75
Gray Forge	9.65 to 9.75

BILLETS.—Conditions in Bessemer pig and billets are very similar, and but little authentic information can be had regarding either. Local mills are reported to be well booked and are asking $16.25 to $16.50 for billets and $17.25 to $17.50 for sheet bars. Middlemen's stocks are held at figures but slightly under these. Yet sales are heard of at $14.75 and $14.85, Pittsburg, for immediate shipment. Other reports tell of quotations by ex-pool members of $15, $15.25 and $15.50. The fear of reduced prices as a result of cheaper Bessemer is assigned as the reason for such sales, which are evidently below present cost. The same uncertainty and anxiety is noted as in iron. The report of the committee of the billet pool now considering reorganization and the controlling of allotments is awaited here with interest. The meeting of mem-

bers of the pool appointed for this week in Pittsburg has been postponed for the present, the committee requiring more time to gather data and to explore as to the possibilities of the proposal to concentrate production.

CONNELLSVILLE COKE.—The rumors current that contracts for furnace coke have been taken at $1.50 per ton do not find confirmation in Pittsburg or contiguous territory. Little new business is being closed, but there has been no change in the circular price of $2, at the oven.

STRUCTURAL MATERIAL.—Contracts for the material for the new bridge over the Susquehanna, near Columbia, Pa., which was figured on early in the fall, will be let Jan. 15. Local mills are figuring and anticipate getting some of the 10,000 tons involved. New enterprises of various kinds are appearing in their primary stages and work now in hands of architects indicates much business as the season advances. Old contracts supply a fair tonnage to the local mills, both of which are fully engaged. Of present business there is none whatever, and inquiry is very slack. Universal plates and angles continue very weak. We quote, f.o.b. cars Pittsburg: Beams and channels 15-inch and under, 1.55c; 20-inch, 1.70c; 24-inch, 1.75c; tees, 1.35c to 1.40c;; angles, 1.10c to 1.15c; zees, 1.30c to 1.35c; universal plates, 1.15c to 1.20c.

BARS.—Business in steel bars is contracted almost to total inactivity. Buyers are willing to contract at 1c and 1.05c, both of which figures are made on spot sales, but there is no disposition to sell far ahead. The association price on bar iron, 1.15c, Cleveland and Youngstown, is maintained on the volume of business going, which is too small to attract better prices. Muck bar at $19.50 and $20 is firm but very quiet.

PLATES.—Sheared plates are in no demand now, and but for old contracts shut-downs would be inevitable to local mills. Tank rules very low and in lively competition shades 1.10c. Shell at 1.25c to 1.30c and flange 1.35c to 1.40c are quiet.

SKELP AND PIPE.—The merchant trade saves the pipe market from utter inactivity and some small purchases are reported of late. For less than carload lots iron pipe continues at 5 tens and 5 per cent, with five tens asked for smaller lots. Steel is in no demand at six tens off. In skelp we continue to quote: Grooved steel skelp, 1.05c to 1.07½c; sheared, 1.17½c to 1.20c; grooved iron skelp, 1.17½c to 1.20c; sheared iron skelp, 1.30c to 1.35c.

SHEETS.—A fair week is reported in sheets, the requirements being mostly for corrugating purposes. Some mills have booked ahead at prices reported slightly higher than quotations given below. Sheets for tinning have subsided considerably and little business is current. The annual meeting of the tin plate manufacturers will likely be held here this week. The sheet manufacturers have likewise called a meeting for this week. Quotations on galvanized sheets are unchanged at 80 and 5 per cent of list and on gauges 26, 27 and 28 black sheets we quote, respectively: 2c to 2.05c; 2.10c to 2.15c; 2 20c to 2.25c.

MERCHANT STEEL.—We continue our quotations on merchant steel in the absence of any business: Soft steel bars, 1.20c; machine straightened tire, 1.35c to 1.45c; spring, 1.30c to 1.35c; open hearth spring, 1.55c to 1.60c; machinery, 1.30c to 1.35c; toe chalks, 1.55c to 1.60c; sleigh shoe, 1.45c to 1.50c.

OLD MATERIAL.—Until the steel interests generally settle somewhat, little or nothing is anticipated in scrap. There are not reports of sales nor changes in other quotations, which we continue: Wrought scrap, $11 to $11.50; cast scrap, $10 to $10.25; car wheels, $11.50, gross; old steel rails, $13 to $13.25; coil spring, $10.75 to $11, gross; hammered iron axles, $16 to $16.50, net; rolled iron axles, $14 to $14.50; heavy melting stock, $12.50 to $13; machinery cast, $9.75 to $10; car wheels $12.

IN OTHER MARKETS.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Philadelphia The mid-holiday week was an exceedingly dull one in iron and steel, and the first week of the new year finds considerable feeling about, to get some idea of the situation. Buyers are making offers lower than December prices, but requirements are not urgent and it is largely a waiting game. In pig iron a sale of 5,000 tons of No. 2 plain is reported on the basis of $11.50, Philadelphia. For No. 2 X foundry iron $12 to $12.25 is quoted and on standard mill irons $11 to $11.25. The steel market is quiet. The last sales of billets were at $17.50, though sellers quote $18 to $18.50, the current demand is for special sizes in small lots. It is thought that the low prices in the last week of December can still be duplicated on firm offers. In finished material a few small orders are on the market, but nothing that will guarantee operation of the mills after specifications now in hand are filled. For plates 1.20c to 1.25c is the market on tank steel, and bars are quoted 1.15c to 1.20c. On heavy melting steel buyers bid $11.50 to $12, or fully a dollar below sellers' views. Neither side of the market is anxious to do business. On No. 1 railroad scrap $13 delivered is the market; on old iron rails, $14 to $14.50; car wheels, $10.50 to $11.50.

Cincinnati. The leading Southern producers of pig iron have been holding prices with general steadiness, in the face of predictions of a lower basis. There is little expectation of trading of any moment until the opening of February, and meantime sellers are not taking the initiative. The shading of Birmingham quotations 25 cents is reported by some concerns, and the belief of buyers that lower quotations will be made later prompts them to wait. Export orders help to reduce accumulations of stock at Southern furnaces, and sellers are counting on pushing harder for this trade in 1897 than in the year just closed. Large expectations of 1897 are indulged, and these save the situation from the full effect of some of the "bear" reports that proceed from Pittsburg. Railroad demand is expected to be fair, and the estimate that from half to three-fourths of the wheat raisers of the West and Northwest have profited in part by the advances in that cereal indicates that the agricultural works will fare better in 1897 than in 1896. We quote as follows: Southern coke, No. 1, $10.75 to $11; No. 2, $10.25 to $10.50; No. 3, $9.75 to $10; No. 1 soft, $10.50 to $10.75; No. 2 soft, $10 to $10.25; gray forge, $9.50 to $10; Ohio silvery, No. 1, $13.50 to $14; No. 2, $12.50 to $13; Lake Superior Coke, No. 1, $12.25 to $12.50; No. 2, $11.25 to $11.75; Tennessee charcoal, No. 1, $13 to $13.25; No. 2, $12 to $12.25; standard Southern car wheel, $14.75 to $15.25; Lake Superior car wheel and malleable, $14.75 to $15.25.

SINCE the reorganization of the Belle City Malleable Iron Co., of Racine, Wis., which took place about a year ago, the company has been forging ahead very rapidly, and the increased business acquired since that time has necessitated the enlargement of the plant. At the last meeting of the board of directors the capital stock was increased from $40,000 to $70,000, and it was decided to build two large new annealing ovens and a new air furnace. The increase in the business of the company is largely due to the efforts of Jno. T. Llewellyn, who a year ago became its president and general manager, and T. T. Wood, who at the same time took the office of general superintendent. Both of these gentlemen have had long experience in the iron business, Mr. Llewellyn having been connected with the Bay View works of the Illinois Steel Co. for 15 years, while Mr. Wood was connected with the Pullman car works and with the Filley malleable iron works at St. Louis for a number of years. The company is now making a Ferret steel for the manufacture of bicycle parts which meets with a ready sale not only in this country but abroad.

THE Illinois Steel Co. has posted notices of reductions in wages, the extent of which in the various departments of the works varies according to the amount paid. It is announced that the cuts extend to all the officers and office employes of the company. Salaries of $10,000 are reported reduced to $5,500, with smaller percentages off those of less amounts. The bad business of 1896 and the survival of unfavorable conditions into 1897 are referred to in explanation of the step. The wages of iron workers at Bay View, governed by the Amalgamated Association, will remain as at present through the scale year, but as a matter of fact very little is being done in iron at this plant.

S. V. D. HUNTINGTON, Pittsburg, has taken the agency in Pittsburg of the Portsmouth Fire Brick Co., of Portsmouth, O., with offices at 800-801 Tradesmen's Building.

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MIGRATION OF THE IRON INDUSTRY.

"Lake Transportation and the Iron Ore Industry" is the title of a paper contributed by George G. Tunell to the December issue of the *Journal of Political Economy*, a quarterly from the University of Chicago Press. The writer dwells in an interesting way on the importance of Lake Superior ores to the iron industry of the country and the rapid expansion of their use, attributing it chiefly to the marvelously low lake freights and the exceptional richness of the ores. He lays stress upon what he terms the "supplanting of the ores of the Eastern region" by those of Lake Superior, and prefaces a description of well-known ores in Pennsylvania, New York and New Jersey with this paragraph:

"In striking contrast with the increased production of the lake region is the rapid decrease in the amount contributed by the great mining States of the Eastern region. During the census year 1880 the mines of New York, Pennsylvania, New Jersey and Ohio yielded 4,243,372 long tons of ore, the total product of the United States being but 7,120,362 tons. The production of these States fell off slowly in the years following 1880, but after 1889 the decrease was rapid and continuous until 1895, when there was a break in the downward movement. The share of these four States in the total output of 15,957,614 long tons for 1895 was 1,534,863. Expressed in percentages, there was raised from the mines of these States during the census year 1880, 59.59 per cent of the total product of the mines of the United States, and in 1895 but 9.62 per cent—an enormous falling off. This very great contraction of the product of New York, Pennsylvania, New Jersey and Ohio is the more surprising because most of the blast furnaces of the United States are located within their boundaries."

The concluding paragraph of the paper, which will indicate further its general trend is as follows:

"In view of the facts which have been presented, it ought not to be difficult to understand why the ores of the Lake Superior region are supplanting the ores of the Eastern region. This substitution has been going on rapidly, and should the demand for steel continue to increase at the expense of that for iron, this substitution will persist unless methods be discovered by which good steel can be made cheaply from ores that cannot now be used to advantage."

What has taken place in the years since 1880, in which Lake Superior iron ore production has advanced from less than 2,000,000 tons a year to 10,000,000 tons, is not so much a displacement of Eastern ores as the removal of the iron-making center of the country. The ores of New York, Pennsylvania and New Jersey are used in smaller quantities to-day than in 1880, it is true; but the main reason is not that the blast furnaces once using them are now running on Lake Superior mixtures, but rather that very many of those furnaces are extinct and have not been replaced. It is to a small extent a case of substitution, and to a large extent a case of migration; and it is the blast furnace industry that has migrated. As the iron industry has moved out from the East and selected the most favorable meeting points of the unsurpassed metallurgical fuel of the Connellsville region and the unequaled ores of Lake Superior as its habitat, it has seen a surprising growth. It is this wonderful expansion of pig iron making in the Central West, drawing so heavily upon the Lake Superior supply, that accounts in large part for a percentage of 59.59 for Eastern ores in 1880 and but 9.62 in 1895. The total ore production has more than doubled, meantime, so that what was 59.59 per cent in 1880 is the actual equivalent of only 26.57 per cent of the 1895 total.

That the fact to be emphasized in such a discussion is rather that the use of any sort of ore in many spots in the East has ceased, is evident from a comparison of blast furnace statistics.

There were 57 blast furnaces in New York in 1880, producing 353,001 gross tons of pig iron. In 1895, the boom year, there were 22 effective furnaces in New York, producing but 181,702 tons of pig iron, more than half of which came from the two furnaces on Lake Erie, which never used any but Lake Superior ores.

In New Jersey 20 furnaces were listed in 1880, with a production of 151,830 gross tons, against 12 in 1895, producing 55,502 tons.

In Pennsylvania, in the Schuylkill, Lehigh, Upper and Lower Susquehanna and Juniata valleys—which may be properly called Eastern—there were 158 anthracite and coke furnaces in 1880, producing 1,266,196 tons; in 1895, in the same districts, there were 107 anthracite and coke furnaces with a production of 1,105,295 tons.

Ohio's production of native ores has never been a large factor, comparatively speaking, but in the districts chiefly employing these ores the change is primarily one of blast furnace extinction rather than a displacement of local ores. Illustrating this condition is the following, which we find in a recent issue of the *Engineering and Mining Journal*:

"The blast furnaces in the Hocking Valley in Ohio, none of which are now running, are fast falling into decay. At the time they were constructed these furnaces were considered modern plants in every respect. Some of them were surrounded by workmen's houses, and many of these houses were never used; indeed it is said that several of the furnaces ran only a few months altogether, and one at least never was in blast. The Ohio ores were of too low a grade, containing too much sulphur and phosphorus to make their treatment profitable. Furthermore, the limestone and the Lake Superior ore, which was mixed with the low-grade Ohio ore, had to be transported too far. The Ohio iron industry illustrates the losses to which invested capital is subject, when such investment is not preceded by careful scientific investigation."

In Western Pennsylvania, it is true, there has

been some displacement of native ores since 1880, but the creation of a new pig iron industry in this region in the past 16 years is the towering fact, as it is in Eastern and Northeastern Ohio.

The size of Lake Superior's contribution to the Eastern iron industry may be gathered from the ore shipments to certain docks at Erie and Buffalo. Deducting ore sent to local furnaces at Tonawanda and Buffalo and that forwarded from the Carnegie dock at Erie to Pittsburg, gives an Eastern shipment of about 700,000 tons in 1895 and 500,000 tons in 1896—an amount quite insignificant in comparison with the total production.

The population center and the iron center have been traveling steadily westward, and it is to save the very cheap lake haul from being neutralized by a long land haul from lower lake port that blast furnaces and steel works have gradually moved toward the ore.

The *American Machinist* has gone with some thoroughness into an investigation of apprenticeship in the machine shop of the United States. It concludes that the sweeping statements made in some of the writing on this subject, to the effect that the apprenticeship system is practically abandoned in this country, are untrue. At least, it finds that in the trades of machinist, molder, blacksmith and pattern-maker, apprenticeship is a live institution, though modified considerably by changed conditions in manufacturing. Out of 116 leading machinery building establishments replying to the letters of inquiry, 85, or 73 per cent, take apprentices; and of this number 79 express themselves as in greater or less degree satisfied with the system.

It appears that where apprenticeships have been abandoned this step has been due chiefly to the fact that modern methods of manufacturing machinery are not so well adapted to the system as was the old regime. Specialty shops are so general to-day that the all-around training secured by the generation of machinists and molders now passing away is not possible. The fact that a boy entering a machine shop is put upon a single tool and often kept there, prevents the attainment of skill in any other line; yet it is claimed, on the other hand, that he will be more proficient in his specialty when his term is completed than any so-called "all-around" mechanic, and that the subdivision of work that is more and more the order will insure a demand for his services in his specialty. But even where all-around apprenticeships have been succeeded by what may be termed specialty apprenticeships, the fact of apprenticeship still remains, though the tendency seems to be in such shops to do away with any form of indenture.

The objections of some who contributed to the symposium mentioned above, that apprentices do not stay out their term, that they often prove unfitted for the work, or take the first job that offers a slight increase in pay, are answered by others who suggest that pains be taken at the outset to secure honorable, industrious boys, with some firmness of purpose, and in all cases that a short period of probation precede the term covered by agreement. Yet only 47 per cent of those who reported to the *American Machinist* that they take apprentices have any written agreement whatever—a fact that indicates how lightly the arrangement has come to be regarded in many shops, owing, doubtless, to the realization of the fact on both sides that the shop, under present conditions, can give the boy less of general knowledge of the trade than was aimed at formerly.

MINNESOTA IRON MINES IN 1896.

BY HORACE V. WINCHELL.

The close of the year 1896 finds the majority of Minnesota iron ore companies in a state of uncertainty and even of apprehension as to what the immediate future is likely to have in store. While prices have been maintained at a fair figure throughout the season, and thus it has been possible to make contracts for mining and shipping on a profitable basis and keep them there long enough to accomplish definite results, it is probably true that few companies, on the Mesabi Range particularly, have yet gotten a balance on the right side of the ledger. With a producing capacity equal to the entire demand for Lake Superior ore; with large initial investments in the purchase of properties and their development, the Mesabi produced in 1896 less than three million tons of ore, and some of this has been in fulfillment of contracts made in 1895, and hence at rates in which there was not only no profit but actual loss. When in addition to these facts it is considered that more unsold ore remains in stock than at the same period a year ago, it is evident that although sales of Bessemer ore shipped during the season have shown a satisfactory profit over operating expenses, yet the situation as a whole is not comforting.

This is all true without any reference to the recent mining and traffic deal between the Carnegie and Rockefeller interests. The details of this latter most significant and important agreement have been so fully given in *The Iron Trade Review*, that it is not necessary to repeat them here. The tendency is everywhere toward consolidation and union of interests between furnacemen and mine operators, and such arrangements are undoubtedly advantageous to the contracting parties. As a result of such a move the Oliver mine is this year the largest producer in the Lake Superior region, and although the ore is not of first quality, it displaced much better ore that otherwise would have been disposed of, to the Carnegie company at a good round price. The advantage to the Pittsburg interest has already been commented upon by *The Iron Trade Review*. The advantage to the Rockefeller interest is also obvious. This company not only secures a steady purchaser for a large amount of ore at a price which, including interest, will reach a fabulous sum before the expiration of the lease, but assures for its associated railroad and steamship lines this entire amount of tonnage for the same period of time, and presumably at rates in which there is a handsome profit. Having thus found a market for its Mountain Iron ore it is left in a position to compete on at least even terms with other iron mining companies in selling ore from the other mines controlled by this same company.

Unless the consumption of iron and steel largely increases, the sale of ore mined by companies which have no furnace connections will be subject to greater competition than ever before. Development has been constant and rapid on the Mesabi, and now suddenly a large portion of the market is permanently supplied with all of this class of ore that it can use, and the supply comes from a property which produced only 143,000 tons of ore during the past year. The displacement of Bessemer by open hearth steel is another factor in this question, and may be of such importance ere long as to lower the price of Bessemer ore as compared with non-Bessemer. The demand for new properties has been seriously affected by these and other conditions and the value of ore in the ground has rapidly diminished. So sharp has been this shrinkage in value that an average fee property at present cannot be sold for any larger price than could have been obtained as a bonus for a lease on the same property a short time ago. The large iron mining companies have found themselves with developed mines, whose ore they were unable to market, on their hands, and hence are slow about making new acquisitions and assuming additional responsibilities; and during the past year no new operators have entered the field. Is it then any wonder that a feeling of hesitation and lack of enthusiasm prevails among the owners and operators of iron mines? The harvest thus far has been reaped by the fee owners who have been fortunate enough to lease their mines to strong concerns.

Viewed as a storehouse of iron wealth for the future use of the nation, no fault can be found with Minnesota iron ranges. Hardly a month passes without the discovery of some notable

addition to the ore in sight, and a considerable territory is still virgin soil, untouched by the prospector's drill or test pit. The new discoveries have all been within the boundaries of the iron range as outlined in the reports of the Minnesota Geological Survey for 1892 and 1893, and the facts developed by mining have gone far to prove the correctness of the theory of the origin of the ore proposed by the writer in 1892. The principal explorations have been in the vicinity of Virginia and in townships west of Mountain Iron. Considerable ore, some of excellent quality, has been found in Sections 22, 23, 27 and 28, Twp. 58 R. 20, in Sections 7 and 8, T. 57 R. 21, and also in Townships 57–22 and 56–24. The ore of the western end of the range is not very well known as yet, and some fears are expressed that it is not of the best grade. Indeed the disposition of the low grade ores of this range is one of the great problems for the future to settle. The steady prosperity of the hard ore mines and the probability of a continued demand for this class of ores is leading to renewed activity in explorations on the Vermilion range, both at the old localities and in new sections. Thus at Soudan important lenses of ore are reported from depths considerably below

VIEW OF THE BIWABIK MINE, WEST CUT, OCTOBER, 1896.

their present workings, and lenses that appeared to be exhausted have opened out into magnificent breasts of ore. East of Ely the prospects are not so good, and recent explorations have not been productive of the desired results. It is altogether likely that attention will soon be turned to the western end of the range where there is every indication of the existence of hard ore deposits similar to those of the central portions of the Vermilion.

The ingenuity and varied resources of the mining men of Lake Superior have never been put to severer tests than in the solution of the novel problems that have arisen on the Mesabi range, and it is needless to say that these problems have been solved as fast as they have been encountered. The three methods that have been adopted for mining these flat deposits are: 1. The steam shovel method. 2. The milling method. 3. The underground method.

1. The steam shovel method has its ardent advocates and its strenuous opponents. It is claimed for this process on one hand that the ore cannot be mined without mixing, and on the other that it cannot by any possibility produce a good mixture; that it cannot be used for more than two seasons, and that it is able to take out the ore clean to the bottom of the deposit; that only a few properties are adapted to it, and that it might be used even where a hundred-foot bed of ore is covered by a hundred feet of glacial drift. As usual the truth would be somewhere between these two extremes. There are five mines on the Mesabi that are operated by steam shovel, the Biwabik, Oliver, Ohio, Mountain Iron and Mahoning. These five mines produced about 50 per cent of the output from this range in 1896, of which by far the largest amount came from the Oliver. Early estimates of the cost of mining by this process were ridiculed by many who were not familiar with the conditions existing on the Mesabi, or by those who were not disposed to recognize and admit the significance of these conditions. Although the cost at different mines varies with the depth of stripping, hardness of the ore, shape of ore deposit, ease or difficulty of approach, quantity of ore produced and care required in mining, it frequently happens that a disadvantage at one mine is counterbalanced by an advantageous feature as compared with some other property, and with a given output the total mining costs may not be widely different at different mines. The writer has on former occasions, both in this journal and elsewhere, itemized the factors going to make up this cost, and will not now again repeat them. Suffice it to say that the stripping charge per ton of ore uncovered does not usually exceed six or seven cents per ton for either this or the milling process (although it is said to have been as high as 17 cents at one mine worked by the latter method), and that the cost of shoveling ore out of its natural bed after stripping does not exceed 10 cents, and with a very large output may be less than half this amount. Assuming an output of 200,000 tons, a fair figure for mining cost by the steam shovel process is 15 cents per ton, or 20 cents if all charges are included.

2. The milling process as now developed is essentially new on the Mesabi range. From the foot of a shaft sunk at the edge of the ore body drifts are run out under the ore, and vertical raises are put up through which the ore is shoveled and drawn down into tram cars which are then run to the shaft and dumped into skips. These skips are of various sizes up to six tons capacity, although the most common is half that size. In this system the surface is stripped off as for steam shovel mining, and the investment for plant may be taken as about the same in each case. If the tramming distance is great, mules are successfully employed underground in both

this process and regular underground mining. The output per man runs as high as 20 or even 30 tons per diem for all men employed about the mine, and in case of emergency may be almost double this amount for short runs. From this it is seen that the mining cost by the milling process may be made almost as low as by steam shovel. The mines worked by this method are the Adams, Auburn, and Norman. There is no apparent reason why the ore mined cannot be taken from certain desired strata or mixed as wanted to produce a certain grade by either milling or steam shovel process. At the Oliver during the past season mixing was done by the shovel, in the yard and at the dock, and although numerous delays were thus caused, and the production would have been larger but for these delays, yet an output of 808,292 tons was made with three shovels, one of which was idle about half the time. One advantage of the steam shovel method is ability to respond to any sudden demands for ore, and in fact practically unlimited capacity after the stripping is done. If one shovel cannot do the work, two, three or more can be employed, and several tracks run in on the ore body. On the other hand, a mine can be developed with reference to its entire exhaustion and roomy, economical development and equipment. Broad and high main drifts run the entire length of the deposit, and the outer edge of the ore body is carefully outlined with a view to working the entire deposit at minimum expense. Most of the ore thus far taken from this mine has come out in the work of development, and it is now ready to answer to almost any demands. Mules are used for tramming. The new system of working large rooms with roof supported by saddle-shaped stulls whose feet are set in the solid ore at the sides as developed at this mine, promises to give excellent results, and may prove a great saving of timber and labor. Improvements worthy of note may be seen all along the range, but to describe them would require too much space for the limits of this article. Several new names will appear on the list of shipping mines for 1897, and many of the older ones are now prepared to increase their output. The question is no longer one of supply for an increasing demand, but one of demand for the ore ready to be mined and marketed. From the present outlook, it will take several years for the needs of the country to catch up with the rapid development of iron ore reserves in the North Star State.

VIEW OF THE OLIVER MINE, OCTOBER, 1896.

by the milling and underground systems, while new devices must sooner or later be resorted to at the steam shovel mines.

3. The underground method as adapted to the Mesabi is still in process of development, and different systems will be found in different parts of the same mine. Square sets and various caving systems are seen as well as a sort of "slicing system" similar to the "long-wall" method of coal mining. This underground mining is of course the most expensive, and is only employed where the ore is too deeply buried under glacial drift to permit of stripping. The underground mines are the Canton, Cincinnati, Genoa, Fayal, Vega, Franklin, Commodore, Minnewas, Sellers and the Lake Superior mines at Hibbing. The output per man is from four to five tons (in specially favorable circumstances running up to six or seven) per day. The mining cost varies from 45 to 65 cents per ton, and with a small output or under unfavorable circumstances may be considerably higher.

The equipment required at Mesabi mines is not heavy, but is usually new and efficient, and the mines are as a rule well planned and in fine condition. If it were permitted to particularize, I would say that the Fayal is a model of neatness,

The output of the two iron ranges of Minnesota for 1895 and 1896, by mines, is as follows, in gross tons:

Vermilion Range.

	1895.	1896.
Minnesota	605,024	448,707
Chandler	432,760	471,545
Pioneer	40,054	149,073
Zenith	.....	18,765
Total	1,077,828	1,088,090

Mesabi Range.

Adams	59,141	234,562
Aetna (Lowmore)	.....	17,723
Auburn	376,970	131,478
Biwabik	247,069	242,565
Canton	359,020	16,261
Cincinnati	17,187	57,324
Cloquet (Vega)	47,700	96,280
Commodore	.....	22,063
Fayal	136,601	248,645
Franklin	286,423	231,088
Genoa	.....	17,136
Hale	31,004	70,006
Lake Superior	58,123	67,659
Mahoning	117,884	167,245
Mountain Iron (and Rathbun)	371,274	142,021
Norman	93,392	77,523
Ohio	28,943	69,925
Oliver (Mis. Mtn. and Lone Jack)	500,377	808,291
Sellers	47,433	153,037
Williams (N. Cincinnati)	3,046	11,249
	2,781,587	2,882,079

CAR BUILDING IN 1896.

The iron trade—especially the rolling mill and car-wheel foundry portions of it—is always interested in the status of the car-building industry. The course of things in the last four years has shown that the country has a large surplus car works capacity, and will continue to have a great surplus unless there is a return to something like the 100,000 car record of the few years preceding the panic. Furthermore, there has been no money in the business for even the largest and best equipped concerns. If railroads have paid more than some of them were willing to pay for steel rails, they can have no complaint of the prices on cars, since these represent the contributions of an unprofitable industry to the demands of the existing regime of destructive competition. Much that is interesting in this connection appears in the annual review of the *Railroad Gazette*, from which we take the following:

Some unlooked-for facts are brought out by our annual compilation of cars built at the contracting shops. Not very many, for instance, would regard this year as having shown much improvement over last in the number of cars built. Yet our records show a substantial increase. The number built was actually 51,189 as compared with a total of 38,100 last year. The increase of 34 per cent shown in these figures followed an increase of 111 per cent in 1895, over the abnormally small output of 1894, when but 18,000 cars were built in the year, a number well within the annual capacity of two of the large shops.

We have built, then, in 1896, 33,000 cars more than the total of two years ago, yet the total is still below the lowest of any year before 1894 for which we have figures that are comparable. These go back to 1888, and the lowest total in that period is in 1893, when 56,900 cars were reported built, or about 6,000 more than in 1896. But one of the large companies whose output is included this year did not report in 1893, so that the difference is actually larger. Comparing with 1890, the best year for car building in the last decade (the best for the locomotive builders also) we find that the 1896 output was not half that of the earlier year, when 103,000 cars were built. In both 1891 and 1892 also, the contracting shops turned out within 4,000 of 100,000 cars, so that if the records for those years represent a normal annual addition to the car equipment, the distribution of car orders which may be looked for, with a year or two of good traffic, will put great numbers of people at work. The car-building industry is a far-reaching one, and activity in it sets a long line of trades in motion.

Undoubtedly, we have not been adding a normal number of cars to our equipment, and with better traffic, considerable equipment orders cannot be much longer delayed. But that we shall add nearly 100,000 cars annually for three consecutive years, or for one year, may seem quite doubtful. For one thing, we have learned to make better use of our cars than even a few years ago.

Returning to a comparison of the last two years, we find that the increase of a third in the cars built was, on the whole, fairly well divided among the different builders. Thus, of the 40 freight car companies reporting to us in 1896, 20 did better than last year, building 19,425 more cars, taking the reports together. But there were 13 other companies which report a decrease, the total falling off by such companies being 6,697 cars. These are all the reports that we can compare. Six companies built no cars in either year.

Averaging the figures just given, it is found that the average gain by the 20 companies is 971, and the average loss by the other companies is 515 cars. Much the larger part of the increase given above is credited to the Michigan-Peninsular Car Co., which did very little in 1895. Besides this company four others built over 1,000 more cars in 1896 than in the previous year, and three others over 500 more. Two companies fell off over 1,000 cars from their 1895 figure.

Much the largest single order given out by any one company during the year was the Baltimore & Ohio contract for 6,000 cars in May last. There were, however, a considerable number of other large contracts which may be mentioned. The New York Central soon after the beginning of the year ordered 2,150 cars. During the year the Erie ordered 2,200, the Lake Share & Michigan Southern 2,100 and the Illinois Central 1,800 altogether. Besides these orders about seven other companies ordered 1,000 or over, and these 11 companies together ordered over 20,000 cars, or 40 per cent of the total built in the year.

The disastrous times which the car builders have experienced in the last few years is reflected in the long list of failures and of shops going out of business, besides those which have not built cars in the last few years. Among the shops which have passed out of existence are those of the Gilbert Co., in its time one of the most famous car building firms; the shops at Harrisburg; Huntington, Pa.; Lafayette, Ind.; Duluth, Minn.; Muskegon, Mich.; Watsontown, Pa.; Dauphin, Pa., and the Schall Works at York, Pa. Very few new companies, those at Depew and Madison, Ill., being the largest, have been opened since 1890.

Nine companies built 474 passenger cars in 1896, and the same companies built 430 cars in 1895, an increase of over 10 per cent. How this compares with the work of other years is shown below:

1896	1895	1894	1893	1892	1891	1890
474	430	516	1,986	2,195	1,640	1,654

Obituary.

James H. Goulds, of Seneca Falls, N. Y., president of the Goulds Mfg. Co., died last week of acute Bright's disease, after an illness of only 36 hours.

Gen. Francis A. Walker, the eminent economist and statistician, was stricken with apoplexy at his home in Boston, Jan. 5, and died soon after. For a number of years he has been president of the Massachusetts Institute of Technology. Coming out of the war with the rank of brigadier general, he taught classics for a time, then did editorial work. In 1869 he was appointed chief of the Bureau of Statistics at Washington, and in 1870 superintended the Ninth Census. From 1873 to 1881, with occasional leaves of absence, he was professor of political economy in the Sheffield Scientific School at New Haven. In 1878, he went to Paris as commissioner from the United States to the international monetary conference. He conducted the census of 1880, and the next year became president of the Institute of Technology. In the past few years he has contributed much to the literature on bimetallism. An invitation from President Harrison to act as a member of the international monetary conference of 1890 he declined. He was in his 57th year.

Personal.

W. P. Thornburg, of Columbus, O., general manager of the Columbus & Sandusky Railway, has been elected president of the Shelby Tube Co., Shelby, O., succeeding Col. D. L. Cockley, who resigned.

Andrew Carnegie will be given a reception by the Johnstown, Pa., Board of Trade on the night of Jan. 21, and will make an address.

W. R. Stirling, who resigned the position of first vice-president of the Illinois Steel Co. last spring, in order to take charge of the affairs of the Universal Constructon Co., has now resigned the presidency of that company, intending to connect himself with another line of business. Before doing so, however, Mr. Stirling intends to make a long expected trip to Europe.

H. K. Gilbert, auditor of the Crane Co., of Chicago, up to Jan. 1, has been elected treasurer of the Sargent Co., Chicago.

THE calendars and memorandums for 1897 designed by various manufacturing firms as mediums by which their names may gain greater familiarity with buying constituencies, are quite up to the creditable souvenirs of other years. Those recently received are from Wm. Jessop & Sons, Ltd., bearing at the top a photo-gravure of a forge; the Washington Coal & Coke Co., Dawson, Pa., N. P. Hyndman, sales agent, Pittsburg, the view in this case being of the coking plant of the company; the Sargent Co., Chicago, a January card, carrying a half-tone cut of a 13,000-lb. breeches pipe casting; the Marion Steam Shovel Co., Marion, O., an 11 x 20-inch hanger with calendar leaves alternating engravings of the Barnhart steam shovel, as adapted to various forms of service; the Ashton Valve Co., Boston, a pad mounted on an 11 x 14-inch card, with an attractive landscape at top.

EFFECT OF CARBON CONTENT ON THE ENDURANCE OF STEEL.

BY H. K. LANDIS E. M.

The fatigue of steel and iron under repeated applications of working loads is a subject which has not received the attention it deserves. Data on tensile and compressive strength is voluminous, elastic limit determinations are common, and modulus of elasticity tests are now made by the best laboratories; the importance of the point where the modulus ceases to remain constant, which is called by the French the limit of "*proportionalite*," has not, however, received sufficient attention. Experiments have shown that this point is the real limit of elasticity and is the point that should be used in calculations for safe loads. When bars are subjected to repeated stresses just below the limit of *proportionalite* they will resist millions of such stresses before rupture; when the fibre stresses are just below the elastic limit the stresses which cause failure are numbered by the thousands; while but a few hundred stresses are necessary at points above the elastic limit. Again, tensile strength is not always a safe criterion from which to judge as to the resistant condition of material which has been in use for a long time; fatigue is the result of continued applications of stresses, and the direct results of fatigue are the exhausting of toughness. This does not always mean the lowering of tensile strength, though the elastic limit usually falls. In fact it is even thought probable that, in case no incipient fractures have formed, the tensile strength of hot rolled iron and especially steel, increases up to the point of fracture, although tests seem to indicate that just before fracture, by repeated stresses, the tensile strength falls. In all calculations tensile strength is not nearly so accurate or reliable to form a basis as the elastic limit. The effects of fatigue caused by stresses just above and slightly below the elastic limit are so widely divergent that it is at once evident that no matter what the tensile strength may be, the load should never exceed the elastic limit. As the steel still fails under work below this point, it were better as before stated to take the safe working limit as the limit of "*proportionalite.*"

An increase in carbon content has a marked effect on increasing the strength and raising the elastic limit of steel. It was formerly supposed also to increase its brittleness and to make it more liable to the effects of fatigue, although this view is no longer held by up-to-date engineers. Where weight is a desideratum and great resistance is necessary, high carbon steel must be used by reason of its high degree of elasticity and not by reason of any very superior toughness, which it does not seem to possess. Its advantage lies in the very much more elevated elastic limits. When a steel pin of fixed diameter should have a unit resistance of 40,000 lbs., it is evident that a 0.20 per cent of carbon steel will not answer and that a 0.50 per cent of carbon will, and have a large margin in its favor. The comparative resilience can be seen in Table I., opposite 0.20 per cent C and 0.57 per cent C, as being in this case one to seven. It was in the year 1888 that the United States War Department began a series of tests at the Watertown Arsenal, Watertown, Mass., upon the "endurance of rotating shafts," which have been continued every year since that time, and the results published, along with other tests on structural materials, in an annual volume, "Tests of Metals." Mr. James E. Howard, who made these tests at the arsenal referred to, has contributed a resume to the *Trans. Am. Inst. Mining Eng.*, Vol. XXIV., p. 776, which those who are interested will find valuable. While the tests were made principally to determine "what phases the material passes through prior to complete rupture," a number of very important effects were observed, the following up of which somewhat diverted attention from the original purpose.

The accompanying tables are compiled from the reports for 1888, 1889 and 1894; tests were made at ordinary temperature, with few exceptions at 400 double stresses per minute, and on bars one inch diameter, suspended 33 inches between supports, and loaded at their middle to the required fibre strain while being rotated.

TABLE NO. I.

OPEN-HEARTH STEEL. ENDURANCE TESTS UNDER VARYING LOADS.

Chemical Composition. Per cent.			Mechanical Tests. Lbs. per sq. in.		Alternate Stress Tests.		
C.	Mn.	Si.	E. L.	T. S.	Successive fibre stresses at about equal intervals. Lbs. per square inch.	Total number revolutions.	Final condition of bar.
.09	.11	.....	30,000	52,000	20,000 to 22,000	3,035,500	Broken.
.20	.45	.....	39 500	68,375	25 000 to 37,000	1,213,400	"
.31	.57	.....	46,500	80,000	35,000 to 43,000	2,233 160	"
.37	.71	.....	50,000	85,160	30,000 to 48,000	920,000	* Not Broken.
.51	.58	.02	58,000	98,760	30,000 to 60 000	239,000	Broken.
.57	.93	.07	55,000	117,440	20,000 to 40,000	8 318,500	"
.71	.58	.08	57,000	116,000	30,000 to 50,000	500,000	† Not Broken.
.81	.56	.17	70,000	149 600	40,000 to 58,000	1,412,000	Broken.
.89	.57	.19	75,000	141,000	50,000 to	1.759 000	"
.97	.80	.28	79,000	152,000	30,000 to 40,000	10,080,000	"

* Tested for tension. E. L.—46,730 lbs. T. S.—86,710 lbs. per sq. in.
† Tested for internal strains; none found.

TABLE NO. II.

GAUTIER STEEL. ENDURANCE TESTS; TOTAL OF 66 BARS BROKEN.

Chemical Composition. Per cent.		Mechanical Tests. Lbs. per square inch.		Number of revolutions required to break bars at given fibre stresses in lbs. per square inch.					
C.	Si.	E. L.	T. S	35.000	40,000	45,000	50,000	52,460	55,000
				Revolutions.	Revolutions	Revolutions.	Revolutions.	Revolutions.	Revolutions
.161	.042	42 500	62 000	763,400	**310,100**	**90,300**	49,875	14,800	18,500
.172	.040	43,000	72 000	970,100	**137,925**	**68,880**	35,070	17,900	161,000
.341	.340	52.000	88 390	14,093,000	276,620	105,410	**97,720**	**67,980**	63,300
.552	.138	.....	.....	3,624,400	157 000	85,950	82,750	**43,050**	**37,700**
.733	.035	.....	.....	15 289 1000	300,9 0	210,320	206,850	92 350	**117,000**
.824	.037	.....	.....	.....	375 400	182 200	208,850	116,500	100.300
1.094	.112	.....	.....	.....	314.375	91.375	144,825	29 500	48,300

Black figures are tests near the E. L.

A study of these tables will show certain tendencies without much regularity, indicating that there are other powerful factors not accounted for. We see the effect of stresses beyond the elastic limit in the 0.51 per cent C steel specimen; the effect of increasing the unit load is shown in Table II. In all specimens there seems a decided advantage in higher carbon content in steel, though the number of determinations are as yet too few to allow of any final specific deductions; and it is not the intention of the writer to do this, but rather to call the attention of engineers to the fact that such tests are being made by the Watertown and other laboratories, and that the results of similar experimenting will very probably have a very strong bearing on the adoption of high specification steels.

CHARLES DAVIS, president of the Davis & Egan Machine Tool Co., of Cincinnati, has just returned from a six months' trip to Europe, where he visited Russia, Germany, France, Austria, Norway, Sweden, Belgium, Holland, Denmark and England, establishing agencies in all the large cities in these countries. He secured many large orders direct from consumers, and as a result of his trip the company is now working nearly 600 men 12 hours a day and has orders on its books to keep running with full force until May 1.

Machinery Trade in 1896.

Manufacturers of machinery in the United States, in writing to *The Iron Trade Review* one year ago were generally of the opinion that the boom that came to the manufacturers of pig iron and of rolled iron and steel products in 1895 was not attended by any great benefit to machine shops and foundries. Some of the latter paid high prices for iron in 1895 and secured no advance on their castings over the prices of 1894. In 1896 not a few manufacturers have made improvements that have put them in position to meet competition and push out for larger business. As detailed in these columns some weeks ago, the foreign trade in machinery was the feature of the year, and many firms expect to follow up the work with more vigor in 1897. In response to recent inquiries we have the following statements as to the business of the past year, its additions to plant and to lines of products:

Bardons & Oliver, manufacturers of turret machinery, Cleveland:

Our business for 1896 greatly exceeded that of any previous year. We have added one or two new sizes to our regular line of turret lathes, and have increased our working force probably 25 per cent. During the latter part of the year we have had considerable demand for our machinery abroad. The prospects for 1897 are very favorable.

The Buffalo Forge Co., Buffalo, manufacturers of hot blast apparatus, blowers, fans, blacksmithing tools, vertical and horizontal engines:

While for a time in the recent Presidential campaign, our business in common with that of all American manufacturers, suffered a considerable falling off, the total amount of our business for 1896 has exceeded considerably that of 1895. During the same comparatively short period of time, the decrease in prices was not so marked as the decrease in demand, for the reason that prices for some time previously had been steadily going lower, leaving no margin for a reduction of prices proportionate to the diminution of demand. The natural accompaniment of slow collections was felt by us in common with the rest of the business community, but we are happy to be able to state that financial casualties among our customers have been very much less than we at one time anticipated. Indeed, our losses owing to bad debts have been actually less the past year than for several years previously. While, of course, this is doubtless to be accounted for in large part by the closer scrutiny given credits in times of depression than in times of more active demand and better prices, we consider that it is a very significant indication of the substantial solvency of the mercantile and manufacturing interests of our country to-day resulting from the weeding out process which has been going on for the past three years.

There can be no difference of opinion as to the prospects of business for the present year. The result of the recent general election was in accord with the almost unanimous sentiment and interests of the business public, and while no largely increased demand has immediately made itself manifest, and indeed was not desirable, the general situation and feeling has been vastly improved, and cannot but make itself steadily apparent as time passes.

For ourselves, the new 400-page catalogue in library form which we sent you by express on Dec. 23, 1896, illustrates our complete line to date, including our line of high-speed engines, showing by half-tone illustrations our machinery from the details of construction to their application to the work for which they are designed; such as heating and ventilating public buildings, workshops, drying processes of all kinds, forced-draft apparatus for marine and large power plants, etc. We have also added a number of new designs to our line of blacksmiths' and metal workers' forges, drills, punches and shears. We have now under way plans for a large and considerable addition to our works which will give us the room which we have felt the need of for the past year, and enable us to handle to the best advantage the very considerably increased business which we anticipate for this year.

Dietz, Schumacher & Boye, machine tools, Cincinnati:

The first part of 1896 was very good indeed, but the latter part was extremely dull in this country, and had it not been for our foreign business we would have been practically closed down. Since the election we have noticed quite an improvement in business in this country, and consider the prospects for 1897 very encouraging indeed. We are receiving a great many inquiries from our old customers who contemplate making renewals.

The Q. & C. Co., manufacturers of railway specialties, metal sawing machines, etc., Chicago:

The business of 1896 to us has been very much larger than ever before, no doubt due to the great efforts we have made to increase our trade throughout the country. The extensions in our plant and equipment have been very considerable, we having during 1896 moved our shops to Chicago Heights, where we have additional facilities for manufacture as well as for shipment. During the year we have brought out many new styles of metal sawing machines, some of which are particularly designed for special work, such as for the steel casting companies, large ship builders, etc., and our prospects for 1897 we believe are brighter because we are now ready to meet the demand for almost every possible kind of metal sawing.

The Fifield Tool Co., manufacturers of engine lathes, Lowell, Mass.:

The business of 1896 was larger than that of 1895. We have added three new sizes of lathes to our line and made additions to our machinery. The new trade developments have been foreign. The prospects for 1897 are, we believe, for an improved business.

The Weston Engine Co., engine builders, Painted Post, N. Y.:

With us the business of 1896 was nearly double that of other years until May 16th, when our plant was destroyed by fire. At the time our books were full of unfilled orders and our shops with a large number of engines in all stages of construction, several of them being ready for shipment the day of the fire. We immediately leased a large foundry and machine shop in Corning, N. Y., and transferred our force of workmen there, carrying on our work with very little delay and arranging with outside parties for portions of the work that we did not have machinery to do. Thus, we took care of our most pressing orders, being under great obligations to our patrons for their indulgence and patience. At the same time we began the work of erecting a plant of more than twice the capacity of the old one. It is now completed and we are employing a double force of men and running 24 hours per day to fill orders which come from all sections of this country. We are bringing out a new self-oiling engine of our own, the Imperial, with the prospect of more business than ever for 1897.

Warner & Swasey, Cleveland:

We are pleased to state that the volume of our business for 1896 was larger than that of any previous year—larger, in fact, than that of 1895, which up to that time had been the best year in our history. A good portion of the business of 1896 was in foreign trade, although after election the number of orders received from various sources in this country was larger, proportionately, than previous to that time. We trust that this augurs well for the year upon which we have entered.

Norton Emery Wheel Co., manufacturers of emery wheels, Northampton, Mass.:

Our business for 1895 was considerably larger than for any other year, and 1896 will show a very satisfactory increase over 1895. We have therefore planned to increase our facilities for production quite largely and have in process of completion a fine new brick and iron building, 150 feet by 100 feet, two stories and basement, which is to be fitted up with all modern improvements. We are anticipating a good business for 1897.

The Acme Machine Co., manufacturers of bolt, nut, and special machinery, Cleveland:

We have, as you know, devoted ourselves for a good many years to the study of one problem, that of screw threads, or the production of bolt and nut machinery with a full intention of beating the world in that line of product. This policy enables us to report a gratifying increase of business year by year, last year being no exception. This policy always gives us an ever widening market, until it extends now to almost every civilized country.

We have made no additions to our line of product. We shall make no large extensions of plant or equipment. About this season every year it is our settled policy to discard some old tools and methods, in favor of new tools and methods to bring us thoroughly up to date. There has been no new trade development in the year except as we said above "an ever widening market." We certainly look forward hopefully to business of 1897, as we propose to devote ourselves more thoroughly to our problem, and if a possible thing to make it better this year than ever before.

Cleveland Twist Drill Co., manufacturers of twist drills, Cleveland:

The total volume of our business for the year just closed was a little larger than for any previous year. The prices for 1896 have averaged lower than for any previous year, so that the total shipments of our goods from our factory based upon previous prices would be considerably larger than for any previous year. We are always looking out for new tools that will add to our line, and during the past year have added several new tools, notably the oil tube drills for bicycle work; the combined countersink and drill for machine shop uses. We

have also largely added to our stock of reamers, and during the past year have also increased our facilities for grinding reamers, and have added several new lathes in our turning department. We have also built and installed several milling machines for milling twist drills, so that we are in better shape than ever to take care of the rapidly growing demand for our goods. There has been a notable increase in the demand for our goods abroad, and we are now shipping to almost every quarter of the globe. We have been somewhat disappointed in the demand for goods since the election, but believe that it is better for all kinds of business, that the revival should be slow and sure, rather than spasmodic. We see no reason why the year 1897 should not be a prosperous one.

The Bickford Drill & Tool Co., Cincinnati, O.:

The past year has, of course, been a trying one to machine industries. In the beginning of the year the business was fairly good, but towards the middle it fell off completely, owing to the political agitation, and prospects were very discouraging. We, however, used that time to move out of our old building temporarily, tear it down and erect on the old site our new factory, we are now occupying in good shape. This factory we believe to be the most complete, thorough and perfect establishment for the manufacture of machine tools that we have ever seen. We have in this factory about 30,000 square feet of floor space which is supplied with the most perfect natural light which we have seen in any shop. On the lower floor we have our heavy tools, and our main erecting rooms, which are all fitted with powerful traveling cranes. On the second floor we have our tool room, the light tools and the office. On the third floor we have also our lighter machines and the drawing room, and on the fourth floor we carry our finished stock. The building is supplied with all modern conveniences and improvements for the rapid production of our work, and also for the convenience and comfort of our hands, and we are confident that if business picks up, as we expect it to, we shall keep this new factory thoroughly employed all the time. We have during the year added a large number of tools to our equipment and are at the present time putting in four additional lathes to supply a want in this department.

We have received this year a large amount of European trade, and it has been very satisfactory so far. It is our intention to put forth special efforts in 1897 for an increase in this respect and secure business from foreign fields, which up to the present time we have not been able to adapt. Considering the fact that we were able this year to put up this new building, and thoroughly equip it for the future trade, we consider the year very satisfactory and must say that the prospects for the next year never looked more favorable. We are confident that with the return of confidence, business will again get back to a satisfactory state and be of benefit to machine tool builders especially.

The Cincinnati Milling Machine Co., manufacturer of milling machines and universal cutter and reamer grinders, Cincinnati:

Our business in 1896 was considerably beyond that of any previous year. We increased the size of our plant by the addition of new buildings and machinery fully 50 per cent, added several sizes to our line of milling machines; and we have just completed the first lot of an improved universal cutter and tool grinder. A large foreign trade, which has been the basis of the above increase, is still the most prominent source of demand for our product. We have, however, noted a decided improvement in our domestic business since the election. We enter the new year with a good many unfilled orders in our books, and the prospects for a large business have never been brighter.

The Pratt & Whitney Co., machine tools, Hartford, Conn.:

The business of The Pratt & Whitney Co. during 1896 fell short of that of 1895 about $50,000, but exceeded in volume that of any other year. From July to December, inclusive, about one-half the shipments were of machines to European countries for the manufacture of bicycles. No material additions to buildings were made during the year, but those previously built and not fully occupied have been filled with machinery and additional room will doubtless be required in 1897 to facilitate the execution of orders for adjustable multi-spindle drills, automatic weighing machines, bench lathes and milling machines, for which the demand is growing. The new year opens with a goodly number of orders on the books and a prospect of some improvement in demand for tools over that of the past year.

The Frick Co., manufacturers of Eclipse machinery, steam engines, boilers, etc., Waynesboro, Pa.:

The volume of our business in 1896 was about 40 per cent more than in 1895. The profits in proportion to the business were not quite so large as in 1895, as we found it necessary in many cases to cut closer to get orders during 1895. We have added to our line a threshing machine department, to be known as the "Landis Eclipse," and are putting up a new erecting shop for this line of machinery. We are also adding a drop forge department, putting in several drop hammers and an oil burning heating system used in connection with our hammers and trimming press. We are also adding a galvanizing department, and will put in the electric galvanizing system recently introduced by party from Germany.

About half of our orders during 1896 were for ice and refrigerating machinery. This is our largest single department. We also have a very good trade on our small machinery, such as traction and portable engines, saw mills and threshers. The prospects for 1897 are very good. We already have more orders for ice and refrigerating machinery than we ever had at this season of the year. The outlook for our lighter lines is also good.

The Bullard Machine Tool Co., Bridgeport, Conn.:

The year just closed has not realized the expectations indulged in during its early days, but it has shown better results than any year since 1892. The prospects for the current year are most encouraging.

Brown & Sharpe Mfg. Co., machinery tools, Providence, R. I.:

In regard to the conditions and prospects of the machine tool business, would say that it is at the present time, and has been during the past year, unsatisfactory as far as sales in this country are concerned, but for the future there seems to be a more hopeful feeling, based largely on the belief that the gold standard is to be maintained; but there is still enough uncertainty in regard to tariff matters to prevent manufacturers from enlarging their plants or starting new enterprises. We believe there will be a gradual improvement in all kinds of business during the year 1897, but no boom, unless unhappily a foreign war should take place, in which case, undoubtedly, the demands for arms and war material would stimulate the machinery business in many lines. There has been a substantial increase in the amount of business we have done in 1896 over that in 1895. The number of hands employed January 1st was 1,148, which number has been increased during the year to 1,328. The works have been run 10 hours per day throughout the year. Fifteen old machine tools have been taken out and 122 have been added. We have added a number of small tools to our line during the year, and the increase in our business is due to the demand early in the year from the bicycle trade, general interest in the new designs of our machines, and an unusually prosperous condition of business in Europe.

Hendey Machine Co. manufacturers of machine tools, Torrington, Conn.:

It has been our good fortune the past year to have the largest business in the history of our concern. Our business has been chiefly export, and we have had more than we could do for the entire year. We have lately built a new factory, of which notice has already been given in the trade papers. This we are just about to occupy, and during the next year we expect to increase our facilities considerably and get out more machinery than during the past year. We look for improvements in our domestic trade, and trust we may not be disappointed.

The Lodge & Shipley Machine Tool Co., gengine lathes and standard machine tools, Cincinnati:

Our business for 1896 shows an improvement in volume of 50 per cent. We have added 31 machine tools, besides a complete electric light plant. We have also added about 12,000 square feet of space. The only new trade development in the year was the export trade, which included almost every European country. The prospects for 1897 we consider good.

Hill, Clarke & Co., iron and brass working machinery, Boston:

Our business for 1896, at this office, is nearly as much in amount as it is in ordinary good times, but the fact that our business has kept up here so nicely has been on account of our large foreign trade. If we had depended upon home trade alone our business would have shown a falling off of near 75 per cent. Our home trade up to the first of June last year was very satisfactory, but as soon as it became known that the Democratic convention was going to indorse the free coinage of silver, our trade at our Chicago store, which is entirely confined to the States immediately tributary to Chicago, dropped off about 80 per cent, and it was not until after the election that business there revived at all. In the month of November our business showed a gain of nearly four times what it had been any month since the last of June, and last month shows a still greater gain.

We think that business is on the road to slow recovery, but it is still very sensitive, and a failure of any importance, or some rash act of Congress, retards its recovery for quite a long while.

ELECTRIC LOCOMOTIVE FOR SWITCHING.

The use of the electric locomotive for switching purposes in the freight yards of steam railroads is likely to receive an impetus by the fact that one is now employed in connection with the New York, New Haven & Hartford road, at New Haven, Conn. This locomotive is in constant service switching freight cars between the main line of that road and a number of factories located along the river front.

The line is about two miles long, and is the property of several large manufacturers—the Bigelow Co., manufacturers of boilers; the National Pipe Bending Co., the Quinnipiac Brewing Co., the New Haven rolling mills and others. It starts at the tracks of the N. Y., N. H. & H. R. R., at Cedar Junction, which is about a mile from the New Haven passenger depot, and follows a devious course, throwing off sidings at each of the different factories. The track is of regular steam railroad type with heavy steel rails, well ballasted and provided with switches and turnouts. In addition to the curves there is a 2½ per cent grade against the load both ways on each side of Grand avenue.

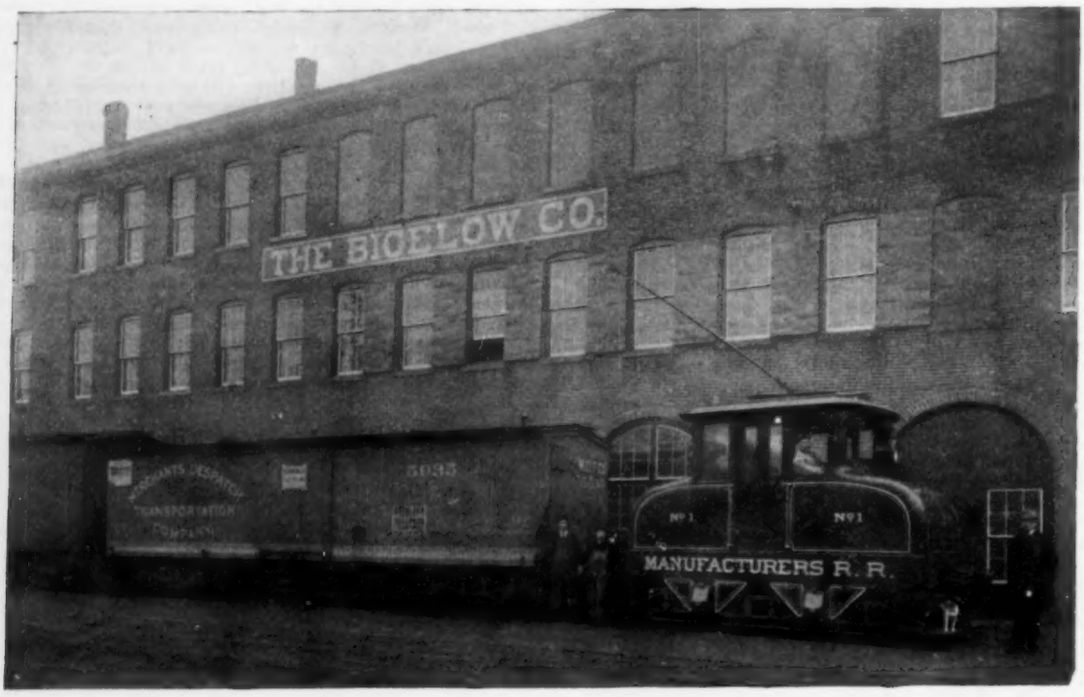
The practice followed by the manufacturers hitherto in switching their cars has been for the freight engines of the N. Y., N. H. & H. R. R. to drop the cars at the Junction; thence they were hauled to the different factories by horses. This method was so slow and the several curves and grades were so hard upon the horses, that the manufacturers were driven to the conclusion that some other method of traction must be employed. Steam traction was rejected for the reason that the line runs for some distance along a frequented thoroughfare. The steam locomotive would also be standing idle under steam for a large part of the day, and consuming coal uselessly was a weighty consideration.

Electric traction was finally adopted as presenting many economical and other advantages, and an order was placed with the General Electric Co. for a 30-ton locomotive which the company could guarantee would haul two loaded freight cars up a 2½ per cent. grade at a speed of seven miles an hour.

The locomotive was delivered at New Haven on Dec. 8; and on Dec. 11 was put into actual operation without preliminary test on the line. Since that date it has been handling the entire movement of the cars between the factories and the Junction. On receipt of the locomotive, the manufacturers painted upon the cab the words, "Manufacturers' R. R. No. 1," and after two weeks' experience are proud of their new acquisition. The dimensions of the locomotive are as follows: Weight, 58,000 lbs.; draw bar pull, 7,000 lbs.; Length over draw-bars, 16 feet 6 inches; height over all, 11 feet 6 inches; width over all, 8 feet 3 inches; wheel-base, 5 feet 6 inches; diameter of drivers 44 inches; number of drivers (with cast iron centers and steel tires), 4; size of journals, 5½ inches; gauge, 4 feet 8½ inches; voltage, 500; amperes, full speed and normal draw-bar pull, 600.

There are two motors, each axle being provided with its own motor. The motors are gearless and are supported upon a system of spiral springs resting on the side frames of the locomotive truck. The suspension being entirely upon springs, wheels are free to adjust themselves to the irregularities of the the roadbed, and the wear on both tracks and motors is thus consequently diminished.

In the armatures the iron clad type of construction has been followed—that is, the windings are placed in a mica lined slot cut in the surface of the laminated core. The armature and communicator are upon a sleeve through which the axles pass. The sleeve rests in bearings on the motor frame. Two projecting arms from the sleeve fit into the openings in an iron plate loose upon the axle, and similar projections from the wheel enter the plate from the other side, so that as the armature revolves the wheels are revolved also. This coupling, being flexible, allow perfect freedom of motion. The commutators are of substantial construction and each motor has four sets of brushes.



ELECTRIC LOCOMOTIVE FOR SWITCHING.

The truck is constructed of I beams and forms the foundation for a locomotive cab, of sheet iron with sloping shields at each end. It has two hinged doors, one on each side, and sliding windows at the sides, the front ones being stationary. As there are windows on all sides, the motorman has a view in all directions. The interior of the cab is finished in cherry and contains the rest of the electrical equipment—automatic circuit breaker, controller, lightning arrester, reversing switch, air pump, air gauge, etc. The controller is the L2 series parallel type, arranged for the control of two motors. It is of the same general type as the K2, used in ordinary street car practice.

The automatic circuit breaker is of 500 amperes capacity and involves also the magnetic blow-out principle, as does the lightning arrester, which is set upon the floor of the cab behind the controller. In the front of the cab and above the controller is a circular dial ampere meter reading to 500 amperes and facing the motorman is the air pressure gauge. On the other side of the cab, opposite the controller, is an oscil-

lating cylinder air pump driven by a motor. This furnishes air to two air tanks suspended beneath the cab and is automatic in its action.

The air pressure pump is controlled automatically by a pneumatic governor, consisting of a cylinder containing a piston working against a spring. The action of this automatic control is as follows: A pipe running from the main reservoir enters the cylinder below the piston. As the pressure rises the piston is forced upwards against a spring. The other end of the piston rod carries the contacts through which the pump motor circuit is made and broken. When the pressure falls below that at which the automatic control is set the spring forces the piston down and the circuit is broken. Any arcs that may be formed when the contact is broken are blown out in the magnetic field. The locomotive is provided with a chime whistle blown by the compressed air and a railroad head-light is set upon each shield. Beneath each one of the shields is an iron sand box provided with pneumatic feeding device.

Electricity for this locomotive is furnished from the Fairhaven & Westville power house which stands on Grand avenue, about the middle of the line, and the current is taken by trolley from an overhead wire suspended from brackets. The operation of the locomotive is marked by great smoothness, and without load it can be run at almost any speed, and with a load starts without a jerk. It responds immediately to the motion of the controlling lever and can be backed up to a freight car for coupling as gently as the movement of a hand. One of the difficult duties it has to perform is the kicking of the freight cars over the curves in the New Haven rolling mill, in which there is one with a radius of only 50 feet. The locomotive can handle seven heavily loaded cars around this curve as easily apparently as it can handle two. Its operation is already attracting considerable attention from railroad engineers, several of whom have visited the scene of its operation. In order to show one of the visitors what the locomotive would do, six loaded cars were hauled up the steepest grade with the slack all out, the start being made on a grade of about one per cent. But 150 amperes were required to start this heavy train, and it moved off smoothly and gradually.

New Rules for Naval Plate Tests.

The result of the investigation into the quality of the hull plates furnished by the Carnegie Steel Co. for the battleships Kentucky and Kearsage, as intimated in these columns a week ago, is a report that the steel company complied fully with the specifications under which the steel was furnished. It is expected, however, that specifications will be changed so that the material furnished for bracket and hull plates will stand a wider range of tests. The annealing of plates has been suggested as one additional requirement. More stress will be laid upon transverse tests, also. Assistant Naval Constructor Robert B. Dashiel; member of the special board which has been testing the Carnegie plates; Chief Constructor Hichborn, Assistant Secretary McAdoo and Secretary Herbert held a consultation on Jan. 2. At the conclusion of this meeting, Mr. McAdoo said the department has in contemplation a plan to increase the number of inspectors, and that civilians would be added to the naval officers now engaged in that work. The salary is $3,000 a year. It is the intention to have one or more inspectors at each of the mills where hull and armor plate is manufactured.

The Newport News Dock Co. has been ordered to complete the Kentucky and Kearsage at once. All the plates examined will be used, since all stood the tests provided for in the specifications. The inquiry has shown that if the Government desires plates possessing qualities not possible under present requirements of high tensile strength, which involves high carbon, it will have to modify its exactions in some other particular. It turns out that the inspection department and not the material furnished by the Carnegie Steel Co. should have been the subject of investigation; and in view of the armor plate inquiry of two years ago, it would seem that more care should have been shown in the initiation of the present investigation. Popular prejudice is easily aroused and even among well-informed men the effect of some of the statements made in connection with the recent investigation has been unjustly prejudicial to the steel company.

PITTSBURG FOUNDRYMEN'S ASSOCIATION.

The Pittsburg Foundrymen's Association met in the rooms of the Builders' Exchange on Monday evening, Dec. 28, with President Robert Taylor in the chair. There were present: Robert Taylor, Taylor, Wilson & Co., Ltd.; Secretary, F. H. Zimmers, Union Foundry & Machine Co.; Treasurer, Jos. S. Seaman, Seaman-Sleeth Co.; James Boyle, J. S. McDonald and Benjamin Fuller, Westinghouse Electric & Mfg. Co.; R. B. Lean, Crescent Foundry & Construction Co.; Phillip Mathes, Brittain, Graham & Mathes; Wm. Yagle, Wm. Yagle & Co.; Thos. Smith, Hydraulic Machine Co.; Jas. Altsman, James Collord & Co.; Wm. Mobberly, H. J. Johnson, Taylor Wilson & Co.; T. E. Malone, J. S. McCormick Co.; F. A. Bauer, Standard Mfg. Co.; Samuel Hay; Mr. Barker, Pittsburg Mfg. Co.; W. L. Sharp, W. L. Sharp & Co., Steubenville; A. B. Harrison, Clinton Iron & Steel Co.; Jas. R. Mills, Jr., *The Iron Trade Review*. Routine business was disposed of and, upon the recommendation of the executive committee, the following new members were elected: James Boyle and J. S. McDonald, Westinghouse Electric & Mfg. Co.; Thos. D. West; Phillip Mathes, Brittain, Graham & Mathes; W. L. Sharpe & Co., Steubenville.

The paper of the evening, read by A. B. Harrison, Ph. D., chemist of the Clinton Iron & Steel Co., was on "Freaks of Foundry Iron." It is as follows:

Freaks of Foundry Iron.

Our subject, "Freaks of Foundry Iron," is a peculiar one. We might truthfully say that there are no "freaks" either in nature or in applied sciences. Webster says a freak is a "capricious change," "a whim." We use this term, however, meaning a result unlooked for and not explained by previous conclusions. Freaks are the effects either of transgressed laws or of resultant laws. We purpose, then, simply to submit some analyses of foundry irons and the results obtained in a series of physical tests. Before proceeding further, it will be necessary to give a brief description of the tests and test pieces used:

Fluidity.—To determine the fluidity we use two tests. The iron must be fluid enough to travel a distance of 24 inches, using a pattern 24 inches long, by two inches wide and 3.32 of an inch thick. Test pieces are always made in pairs. To further test the fluidity we use a pattern having the same thickness and length but being only one inch wide. Both patterns have a three-quarter-inch hole about three inches from the end, giving a chance for the iron to show any tendency to "cold shot."

Softness.—The size of pattern used for test for softness is 24 inches long by two inches wide and one-eighth of an inch thick, with three-quarter-inch hole one inch from end. These strips, as well as above fluidity strips, are tried with a file, and any hardness of edges or ends noted. All these strips are gated at one end only.

Shrinkage.—For shrinkage a bar one-half inch square by 12 inches long, cast between metal yokes, is used. This bar is then placed, when cool, between the yokes, and distance between yoke and bar measured with a wedge-shaped gauge reading to one-thousandth of an inch.

Tensile Strength.—Bars 1¼ inches square by 12 inches long, reduced at middle section to a diameter of one inch are used. These are cast in pairs.

Transverse Strength.—Bars one inch square by 24 inches long are used for transverse strength tests, the bars being broken on 12-inch centers.

All of these castings are made in sand used for general bench-work, being cast horizontally, and, excepting shrinkage bar, gated at one end.

High Silicon.—It has been generally acknowledged that irons high in silicon are soft but weak. We will submit, however, two analyses with their results, showing high silicon in each, the second, however, having more sulphur by many times:

	Si.	S.	P.	Mn.	Grap. C.	Comb. C.	Tensile stren'h.	Trans. stren'h.	Fluid'y.	Softness.
No. 3,155	3.20	.005	.54	.88	3.60	.06	15,280	2,500	o.k.	1-8 o.k.
No. 4,595	3.50	.090	.54	.80	3.60	.06	23,450	3,000	o.k.	1-8 o.k.

You will notice from these a great difference in tensile strength. Comparing them you notice the great difference in sulphur content, the other ingredients varying but little. We might deduce from this that the large amount of sulphur in

the second gave the increased strength. But wait a moment. Here is another iron varying but little in analysis from the first and weak iron, but varying greatly in strength:

	Si.	S.	P.	Mn.	Grap. C.	Comb. C.	Tensile.	Trans-verse.	Fluid'y.	Soft-ness.
No. 4,299	3.05	.008	.53	.71	3.60	.12	29,170	3,500	o.k.	1-8 o.k.

In all these tests the strips were fluid, giving good clean castings, but the "3-32 inch" strips were hard on extreme ends, contrary to what might be expected.

Here are three irons varying but little except in sulphur, but giving contradictory results. Is this not perplexing? The solution I leave with you.

With the above as examples of high silicon irons we will now submit irons of much lower silicon content:

	Si.	S.	P.	Mn.	Graph. C.	Comb. C.	Tensile.	Trans-verse.	
No. 3,643	1.20	.029	.71	.65	3.60	.18	28,025	3,100	
No. 2,084	1.15	.036	.69	.42	2.60	.24	22,420	2,400	All
No. 4,792	0.85	.026	.52	.73	3.50	.37	24,446	2,650	strips
No. 1,599	0.85	.021	.94	.74	3.40	.23	23,440	2,500	fluid.
No. 1,336	0.80	.043	.55	.52	3.35	.24	17,961	2,650	

You will notice that these irons gave good tests, yet hardly any one would desire to use irons of such composition.

Phosphorus.—We will not dwell long on phosphorus as an ingredient, only submitting two analyses showing high percentage against low percentage:

	Si.	S.	P.	Mn.	Graph. C.	Comb. C.	Tensile.	Trans-verse.	Fluid'y.
No. 2,147	2.40	.018	1.01	.58	3.50	.10	20,760	2,280	o.k.
No. 4,144	2.50	.019	.41	.65	3.25	.10	20,910	2,850	o.k.

You will notice there is but slight difference in the tensile strength, the greatest difference being in the transverse strength. The fluidity and softness of each iron were satisfactory.

Carbons.—We will submit but two tests, from the many that could be produced, showing variation in graphitic and combined carbons. Notice the tensile and transverse strengths:

	Si.	S.	P.	Mn.	Grap. C.	Com. C.	Tensile	Trans. verse.	Fluid'y.	Soft-ness.
No. 4,270	2.30	.019	.69	.78	3.80	.09	32,085	3,100	o.k.	1-8 o.k.
No. 4,369	2.05	.015	.55	.84	2.90	.32	33,104	3,200	o.k.	H'd.

This is a case that puzzles one to explain results. We could give many instances where phenominal strength would be expected, judging from analyses, but where weakness was found, and many cases where we expected weak bars but found high tensile results. We desire, however, to treat briefly of shrinkage.

Shrinkage:

	Si.	S.	P.	Mn.	Graph. C.	Comb. C.	Tensile.	Trans-verse.	Shri'k
No. 2,161	2.85	.014	.66	.64	3.40	.11	20,000	2,300	.155
No. 2,131	1.75	.020	.67	.43	3.50	.18	20,760	2,250	.157
No. 2,134	1.65	.020	.67	.50	2.95	.20	21,400	2,300	.158
No. 2 147	2.40	.018	1.01	.58	3.56	.10	20,760	2,280	.155
No. 2,177	2.20	.030	.90	.73	3.05	.18	21,783	2,650	.155
No. 2,380	2.15	.003	.57	.55	3.60	.08	19,230	2,510	.155
No. 2,088	1.55	.014	.58	.54	4.10	.18	.....	.....	.148
No. 2,128	4 45	.046	.86	.45	3.25	.18	.....	.....	.145
No. 2.358	2.50	.017	.51	.66	3.15	.15	.....	.....	.145
No. 2,194	2.10	.014	.69	.57	2.75	.20	.....	.....	.145

You will notice the varying amounts of usual impurities but the uniform shrinkage. High phosphorus and low phosphorus, high graphite and low graphite are shown, but shrinkage is the same. As we desire to treat of several more peculiarities of irons, we will not dwell longer upon this one subject, although very interesting and full of value, but we will speak of the

After-Treatment of Test Pieces.—We merely clean our bars from the adhering sand and then pull them. Having read in one of the trade journals of the effect of "tumbling" test bars in the barrel, we decided it might be interesting and useful to gather some data ourselves. So we have had several such tests made, taking one of the tensile bars for usual test, putting the other bar (always casting these in pairs on one gate as mentioned before) in the barrel, tumbling them once a day. The results are as below. We do not attempt to explain them. We did not try many bars with prolonged tumbling, as we were at the time very busy and could not give more time to the matter. It would have been interesting, no doubt, to try a number cast upright, and tumbled for the same period in the barrel, to see the effect of the different strains in the same iron and if in fact any general rule could be decided from such data.

Notice the varying percentage of increase and decrease in strength of tensile bars. We have not submitted the analyses, as that would make this talk very tedious and long, but these tests were made daily for a period of two weeks, not trying to select abnormal but rather normal irons:

	Tensile strength. Before.	After.	Increase %	Dec. %
No. 4,684	25,462	28,780	13.03	.....
No. 4,689	30 557	30,557	nil	nil
No. 4,696	22,930	24,827	8 27	.....
No. 4,699	26,865	31,703	18.00	.....
No. 4,744	24,010	21,640	.....	9.87
No. 4,752	25,040	24,323	.....	6.23
No. 4,757	22,165	29,793	34.41	.....
No. 4,769	25,592	24,191	.....	5.47
No. 4,777	28,138	23,450	.....	16.66
No. 4,784	25,462	24,572	.....	3.49
No. 4,792	24,446	22,039	.....	9.84
No. 4,807	28,025	28,393	1.34	.....
	Transverse strength.			
No. 4,744	2,400	2,650	10.41	.....
No. 4,733	2,800	3.150	12.50	.....
No. 4,729	2,800	3,150	12.50	.....
No. 4,722	2,400	3,125	30.20	.....
No. 4,797	2,720	2,900	6.62	.....
No. 4,792	2,650	2,830	6.79	.....
No. 4,644	2,400	2,800	16.66	.....
No. 4,059	2,200	2,850	29.54	.....
No. 4,807	2,350	3,400	44.68	.....

We also thought it would be interesting to note the difference, if any, in the way the transverse bar was placed for breaking. So we had bars cast in pairs. One of each pair was tumbled, and the other was only cleaned in the usual way. We then took each bar and broke it, first with the "cope" side up, then with the "drag" side up. Notice the results:

		Before.	After.	Inc. due to tumbling.
No. 4,811	Cope	2,460	2,610	6.09 %
	Drag	2,560	2,620	2.34 %
No. 4,818	Cope	2,660	2,945	10.71
	Drag	2,750	2,950	7.27

This shows that a greater resistance to rupture seems to exist when strain is applied to drag side of bar, but after tumbling in the barrel there appears to be no practical difference. In No. 4811 the increase in strength of drag over cope was 4.06 per cent, while in bar No. 4818 the drag side uppermost gave 3.34 per cent of an increase.

You might now ask, How can the chemist then be of practical use to the founder? In many ways; and in closing permit me to refer to several cases where the chemist at once located the cause of the trouble. It is usual in cases of hard, brittle castings to blame the pig iron used as the cause. We desire to submit an analysis of cast iron, of the scrap added in the mixture, and of the coke used to melt the same; also analysis of the pig used. The mixture was 60 per cent pig, 40 per cent scrap:

	Si.	S.	P.	Mn.	Graph. C.	Comb. C.
The scrap analyzed...	1.80	.026	1.02	.41	3.10	.28
The pig " ...	1.65	.017	.69	.47	3.45	.11
		Fixed C.	Ash.		S.	P.
The coke " ...	.....	84.45	13.35	.....	1.67	.022

Please note the sulphur in pig and scrap irons; also sulphur in the coke. Notice that the graphitic carbons are excellent, and we would expect from the mixture a good soft casting. Here is the analysis of the casting obtained which, it is needless to say, was hard and brittle:

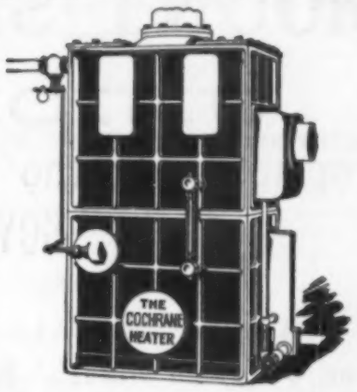
Si.	S.	P.	Mn.	Graph. C.	Comb. C.
1.75	0.156	1 12	.380	2.25	1.20

This, you say, is an extreme case. Yes, but the reason we cite this one is that troubles of this nature frequently arise. In fact, I could mention numerous cases where the founder was led astray by good-looking coke, the same coke having caused him much loss by bad castings, while pig iron was blamed for all the trouble. Therefore we maintain that it is wise in cases of sudden and unexpected changes in product, using the same materials, to have not only the pig iron analyzed but also the coke. In our opinion it will be found that the coke will vary more than the pig iron. We had one sample of foundry coke submitted for analysis which contained over two per cent of sulphur.

In another case of trouble in a foundry we found that the principal cause was in the water used, it being high in sulphur compounds, and consequently the sand, in course of time became highly impregnated with these compounds and caused the trouble. No doubt, many cases arise in your minds where it was the little, and therefore unlooked for, causes which produced your difficulties.

Owing to the statistical nature of the paper it was deemed wise to postpone discussion of the subject until the printed copy could be put in the hands of the members. The discussion will, therefore, be taken up at the next regular meeting—the fourth Monday night of January.

OPEN HEATERS FOR BLAST FURNACES.



"We do not believe in them for plants of this kind," was the remark made to us recently by a prominent engineer whose specialty is the design and construction of blast furnaces.

"Why not?" said we. In reply, he stated that such plants were run continuously night and day, without any stops for examination and repairs, and that therefore closed or pressure Heaters were preferred for this particular service.

Was it not curious that at that precise moment we were shipping two of our large COCHRANE HEATERS to replace some six Heaters of the pressure type, that had given out after a few years' use? These closed heaters had rusted out after continually leaking, and the owners—blast furnace people—thought it advisable to get something better adapted for their purposes.

Hot water—real purification—reliability—ease of operation and cleaning—simplicity and adaptability for the purpose of the material used, insuring freedom from repairs and longevity—these are the advantages which are doubling every year our sales of the COCHRANE HEATERS.

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INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

The Dobbie Foundry & Machine Co., of Niagara Falls, N. Y., has been incorporated, with a capital of $40,000, and directors, John Dobbie, A. J. Dobbie, Alex. J. Porter, A. R. Cow and John T. Horton, of Niagara Falls.

The Johnson Parfitt Tool Co. has been incorporated at Springfield, Ill., with a capital stock of $15,000, to manufacture tools, engines, machinery, etc., by Thos. B. McGregor, Annie C. Courtnay and Thos. F. Sheridan.

The water department, Baltimore, Md., will receive proposals until Feb. 1 for the construction complete of two batteries of two steam boilers, each of 200 h. p, making 800 h. p. in all; one battery of two steam boilers of 200 h. p. each, and one battery of two steam boilers of 50 h. p. each; specifications on application.

A. L. Lincoln, Taunton, Mass., is in the market for iron-working tools.

J. A. Summers, Knoxville, Tenn., will buy a new or second-hand machine for refacing valve seats of steam engines.

Copp & Kern, Woodstock, Va., want to buy machinery for steel-metal working, etc.; second-hand will do.

New Construction:—

Thomas H. Colvin will erect a new foundry building at Providence, R. I. It is to be one story high, of iron and brick, with a slate roof. It will be 102 x 177 feet He will also erect a two-story brick edifice to be used for a pattern building. It will be 30 feet high, 115 feet long and 48 feet wide, with a flat roof.

Orders have been given by the Atchison, Topeka & Santa Fe road for a new wheel shop at Raton, New Mex., also a new paint shop and an extension to the roundhouse. Work will begin on the new building at once.

The new shops now in course of erection by the Herring-Hall-Marvin Co., in East Hamilton, O., are being rapidly pushed towards completion. It is thought that the new building will be ready for occupancy not later than the last of May.

The bill to grant to the Canadian Pacific $20,000 toward the erection at Carleton Place, Ont., of permanent and more extensive workshops has been carried by a large majority.

Additions, Enlargements, Removals, Etc.:—

The Young Reversible Nut Lock Co. is erecting a plant 150 x 50 feet at Minooka, Pa.

The new machine shop which the National Foundry & Pipe Works, Ltd., of Scottdale, Pa., has in course of erection, is to be of brick and steel construction, 50 x 130 feet in size. The firm has on the ground and will install a 100-inch by 12-foot Pond lathe. It is expected to do some experimental work in its new plant within the next few weeks, and the company will operate the portion which has been finished to its full capacity during January, when shipment on the Baltimore contract for water pipe will begin.

The new $60,000 addition of the Newport, (Ky.) Rolling Mill, including two new roughing and rolling mills, together with galvanizing plant, has been put in operation. The enlargement of this mill will employ 65 additional hands, and the entire plant will have a weekly output of 325 tons of steel sheets, and is operated by a Columbian-Corliss engine of 1,000 h. p.

Fires and Accidents:—

At the Cleveland Foundry Co.'s plant, Cleveland, on Dec. 31, an explosion of gas occurred, the flame of a gas stove under test being communicated to the contents of the gas tank from which it was supplied. One of the employes was instantly killed. C. F. Drury, the superintendent, was hurled some distance but was not seriously injured.

At the Lucy furnaces, Pittsburg, an explosion, Jan. 2, badly burned an employe, and set fire to an elevator which was consumed with $3,000 loss.

An explosion occurring at the Stewart Iron Co.'s furnaceat Sharon, Pa., Jan. 2, carried off a portion of the engine house roof, and tore apart many pipe connections. The furnace is idle for repairs.

General Industrial Notes:—

The Westinghouse Machine Co., of Pittsburg, has declared the quarterly dividend of 1½ per cent, payable Jan. 11.

The Maryland Steel Co., of Sparrow's Point, Md., blew in its A furnace Jan. 1.

It is reported that one of the three furnaces of the Troy Steel Co., Troy, N. Y., will be lighted early in January. The steel works of the plant have been in operation about a month.

The Columbus & Hocking Iron & Coal Co. went into the hands of a receiver, upon the application of the receivers of the Baltimore & Ohio Railroad. The company, whose bonded indebtedness is $530,000, owns 13,000 acres of coal lands and five furnaces. It is claimed that the receivership is only temporary.

The Dover Iron Works, Dover, N. J., recently rolled three five-eighth rounds on a 10-inch mill.

It is stated that the Cambria Iron Co., Johnstown, Pa., earned seven per cent in the year ending Dec. 31, besides spending $500,000 for improvements of various kinds.

Worth Bros., Coatesville, Pa., will start their new rolling mill early this month. They recently started their second new melting furnace. They will open an office in Philadelphia in the Harrison Building, under the management of J. B. Newkirk.

At a special meeting of the stockholders of the Akron Iron & Steel Co., Akron, O., held December 24, it was decided to invoice the property at once, place a price on it and advertise it for sale. The mill started Jan. 4 and will be operated as orders are secured.

In Pittsburg an order of court has been made in the matter of the receivership of Jennings Brothers & Co., Limited, di-

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Proprietors of the CELEBRATED Mount Savage Fire Brick

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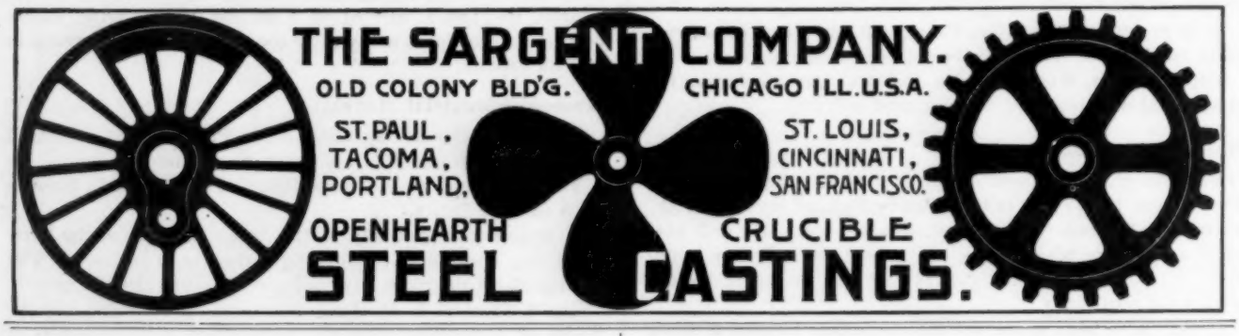

recting that money in the hands of the receiver, aggregating $3,690, be distributed among the former employes to satisfy claims for wages.

At Catasauqua, Pa., the rolling mills of the Catasauqua Mfg. Co. and 59 houses were sold by the sheriff Jan. 2 for $64,000 to C. B. Taylor, attorney for the stockholders.

The Norton Iron Works, Ashland, Ky., have made a reduction in the wages of their employes.

The Duff Mfg. Co., Allegheny, maker of screw jacks, has petitioned the United States Circuit Court for an injunction restraining William Forgey from making a lifting jack which it is claimed is an infringement on patents held by the plaintiff.

The Irwin (Pa.) Electric Light & Power Co. has decided to increase its capital stock from $40,000 to $60,000 for the purchase of additional equipment.

The blooming mill of the Bethlehem Iron Co.'s plant at South Bethlehem, Pa., started Jan. 2, and other departments Jan. 4.

A reorganization of the Sharpsville Foundry & Machine Co., at Sharpsville, has been perfected. Geo. W. Johnson and Thos. M. Eagan have purchased an interest and will conduct the business. The plant will be equipped with new machinery.

Suit has been begun in United States Circuit Court at Cleveland by George Mesta against the Reeves Iron Co., Canal Dover, O., for alleged infringement of plaintiff's patent on apparatus for pickling iron.

The Carnegie Steel Co. has placed in operation, at its Duquesne plant, a metal mixer which will hold 30 tons of molten metal.

The Sheffield Coal & Iron Co., Sheffield, Ala., is arranging for the shipment of 8,000 to 10,000 tons of pig iron to Pittsburg, sending it by way of the Tennessee River to Paducah, and thence up the Ohio.

The Bosworth Tool & Supply Co., Cleveland, has made an assignment.

The Johnson Co.'s steel motor works at Johnstown, Pa., idle for several weeks, have resumed in full.

The property of the Fairchance Furnace Co., at Fairchance, Pa., consisting of 4,925 acres and the various improvements and the Springhill furnace property, consisting of 3,253

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Have a Special Lot of Second-Hand Tools. All in First-Class Condition.

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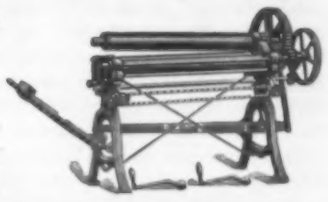

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All Kinds of Pipe, Globe and Gate Valves, Fittings and Appliances for Steam, Gas, Water and Hydraulic Work.

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Agents for the CAMERON STEAM PUMP, which is made in every possible variety, and suitable for all purposes to which Steam Pumps can be applied.

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acres, was purchased Jan. 2, at public sale, by the H. C. Frick Coke Co.

The open hearth mill and the Bessemer blooming mill and billet mill of the Cambria Iron Co. have resumed operations.

The East Rockford Machine Works has been incorporated at Rockford, Ill., with a capital stock of $7,000, to manufacture machinery, by O. B. Harding, F. A. Lindstudt and O. Bergquist.

The Clonbrock Steam Boiler Co., of Brooklyn, N. Y., has taken an important contract. Its Morrin Climax boiler was selected in competition with many others for the entire boiler contract for the Tennessee Centennial Exposition, to be held from May 1 to Nov. 1 next, at Nashville. Naturally the company is gratified at this fresh evidence of the success of its boilers.

A committee of the creditors of the Memphis (Tenn).Car & Foundry Co., said to represent about 80 per cent of the outstanding claims, have asked the court to postpone an order for the sale of the company's property, pending the perfection of the plan looking to a re-establishment of the plant on a sound basis without a sale.

Manufacturers in the vicinity of Harrisburg take a hopeful view of the new year and nearly every one regards it as likely to develop an early improvement in trade. Some of the works have not been doing much for the last five months but they are preparing for a busy year.

The Columbus & Hocking Coal & Iron Co., of Columbus, has been placed in the hands of Jay O. Moss as receiver by the common pleas court. The receiver was appointed on the application of the receivers of the Baltimore & Ohio Railway Co., who took cognovit judgments against the company for $63,405 freight charges.

The Morgan Engineering Co., of Alliance, O., has been awarded the contract for building nine Buffington & Crozier gun carriages for the United States Government. The firm was lowest among a large number of bidders. It will take many months to complete the contract.

The Sterling Steel Co. will be increased by the addition of British capital. The Firth Co., of Sheffield, Eng., important steel producers, will invest in the stock. The plant at Demmler, Pa., will be greatly enlarged and the company will compete for a large amount of the American trade in tool steel. The Wheeler-Sterling Co. will also make additions to its plant and both concerns will be incorporated. The preliminary work will be furnished by the time the annual meeting of the stockholders is held, Jan. 19. There will be many changes in the operations of the companies.

The Rankin & Fritsch Foundry & Machine Co., of St. Louis, will sell out and reorganize. The orders on hand will be filled and the plant will be closed if the deal is not made. The reason is the occupation of the stockholders in other employments. The capital of the company is $275,000, and it has been in business for many years. Several months will be required to fill present contracts.

Cognovit judgments were taken Saturday for amounts aggregating about $75,000, by creditors of Dorner & Dutton Mfg. Co., of Cleveland, and the allied corporation, the Dorner Foundry Co. The Dorner & Dutton Mfg. Co. is an extensive

manufacturer of car wheels and axles, gear and pinions and electric motor trucks. Among the creditors are Bassett, Presley & Train, W. J. Rainey, Samuel Deutsch, the Cleveland Rolling Mill Co., Forest City Foundry Co., the Upson Nut Co. and J. A. Long, receiver of the Falls Rivet & Machine Co. Most of these claims are for amounts under $1,000. The largest claims are those of banks and of individuals from whom money was borrowed. It is expected that a receiver will be appointed.

The ball-bearing car wheels now used on ore cars in some of the Menominee Range mines are the invention of John T. Jones, the well-known mine manager of Iron Mountain, and are manufactured at the Marinette Iron Works, Marinette, Wis.

One of the Woodstock Iron Co.'s Anniston, Ala., furnaces is to be started up early this month.

The Middleton, Conn., cast iron pipe contract brought the very low bid of $18.69 per gross ton, delivered. Philadelphia opens bids for about 5,000 tons of pipe this week, and Brooklyn will want 2,100 tons of six-inch pipe.

Among recent locomotive orders is one for 40 from the Nippon Railway of Japan, said to have been placed with the Baldwin Locomotive Works. It is reported that the Colorado Midland will soon give out an order for cars. The Guatemala Northern will shortly purchase new freight equipment. For 1,000 freight cars placed with the Missouri Car & Foundry Co. by the B. & O. steel axles were specified.

The American Steel Casting Co., Sharon, Pa., has been working for some time on castings for a government order for 20 gun carriages and pedestals to be used in coast defense.

The Edgar Thompson Steel Works resumed operations Jan. 3, after a shut-down in which repairs were made. Several rail orders are ahead.

The Howard-Harrison Iron Co., of Bessemer, Ala., has just shipped 25 cars of a 10,000-ton iron pipe order for St. Louis.

The Tennessee Coal, Iron & Railroad Co. sold in 1896, for export, 33,990 tons of iron distributed as follows: To England, 19,300 tons; to Italy, 4,950 tons; to Germany, 1,000 tons; to Austria, 1,000 tons; to Mexico, 380 tons; to Canada, 4,360 tons; to Japan, 3,000 tons; total exports, 33,990 tons. Practically all the iron has been sold since July 1. It is stated that the prices obtained were in most cases better than those received on domestic business.

The Sheffield Coal, Iron & Steel Co., whose furnaces are at Sheffield, Ala., with mining and coking properties in Franklin and Walker counties, has let a contract for the construction of a five-mile branch railroad, from the North Alabama Railroad, at Russellville, to the brown ore beds, on Hamilton Creek. A contract has been let for furnishing 1,000 tons of ore a day to the Sheffield company.

For the month ending Friday, Dec. 25, No. 1 Furnace of the Duquesne plant of the Carnegie Steel Co. made a total of 17,194 gross tons, or an average of 573 tons a day, establishing a new world's record. For several days 610 tons in 24 hours were turned out and in one 24-hour run upward of 700 tons was made. It is the expectation that both the furnaces now active and the two yet to be constructed will be equipped with 20 sets of tuyeres each, instead of 10, and that eventually 1,000 tons a day from each furnace will be approached.

IRON MOLDERS' UNION No. 27, of Cleveland, is urging upon local members of the Legislature the passage of a bill compelling the management of the Ohio Penitentiary to put the letters "O. P." prominently on all stoves manufactured in the institution. The union alleges that the Cleveland Cooperative Stove Co. has been buying these stoves and putting the union mark on them. The company says that it has never marked stoves bought from the penitentiary with the union mark, but it buys convict-made stoves, which are of inferior quality, so as to keep them off the market in summer time, the stove selling season.

THE Laconia Car Co., Laconia, N. H., was forced into insolvency Dec. 28. The total liabilities are placed at $617,000 and assets at $407,000.

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PAINTED OR PLANISHED IRON JACKETS.

The question of the advisability of using planished iron for locomotive jackets, or a heavy covering of iron or steel painted, has been a subject for discussion occasionally for two or three years. It is on the list of subjects for the consideration of the Master Mechanic's Association at the next convention. It also formed the basis of a recent report to the Central Railway club.

The most exhaustive collection of information on the subject, however, is that contained in a report to the New York Railroad club, Oct. 17, 1895. This was in the form of a comparative statement from ten or more roads in all parts of the country, showing the relative cost of the two practices, and the arguments for and against each. From all these sources there comes a substantial agreement to the effect that the cost of the painted jacket is from $10 to $30 less in first cost, its durability is greater, and the cost of maintenance subtstantially the same. It is also stated the the painted jackets endure with less damage the drippings from leaky roundhouse roofs, blows from a hammer in the hands of an engineer with some ulterior purpose in view, or the weight of a fireman who desires to investigate the interior of a sandbox. As an offset, the paint and varnish are necessarily more or less affected by the heat of the boiler, and to a greater extent in certain spots; repainting is therefore of a patchy nature and the surface of the jacket is unequally protected.

Assuming that the minor advantages and disadvantages counterbalance each other, the matter resolves itself into the simple question of appearances. Which looks better, the painted or planished jacket? If the latter, how much is the added beauty worth in the kind of goods the railroad has to sell?

Strangely enough, the roads following either practice most uniformly, defend the practice on the ground of better appearance, and sometimes put aside the question of relative cost. The locomotive superintendent of the Dominion Atlantic Railway finds the planished jacket cheaper to clean and maintain, but that it does not look nearly so well as the painted jacket. The company does a large passenger, especially tourist, business, and is willing to pay the difference in cost to obtain a more pleasing appearance. The extra cost in this case, however, arises from the fact that the standard color is crimson lake, an expensive color at the start and requiring constant care and a large amount of cleaners' stores to maintain. But where bright and expensive colors are not used, the planished jacket undoubtedly presents a finer appearance, especially when new. With fair usage this condition may remain to a considerable degree for five years. A coat of paint or a new jacket are then the only alternatives. —[Railway Age.

Chicago's Iron Working Industries in 1896.

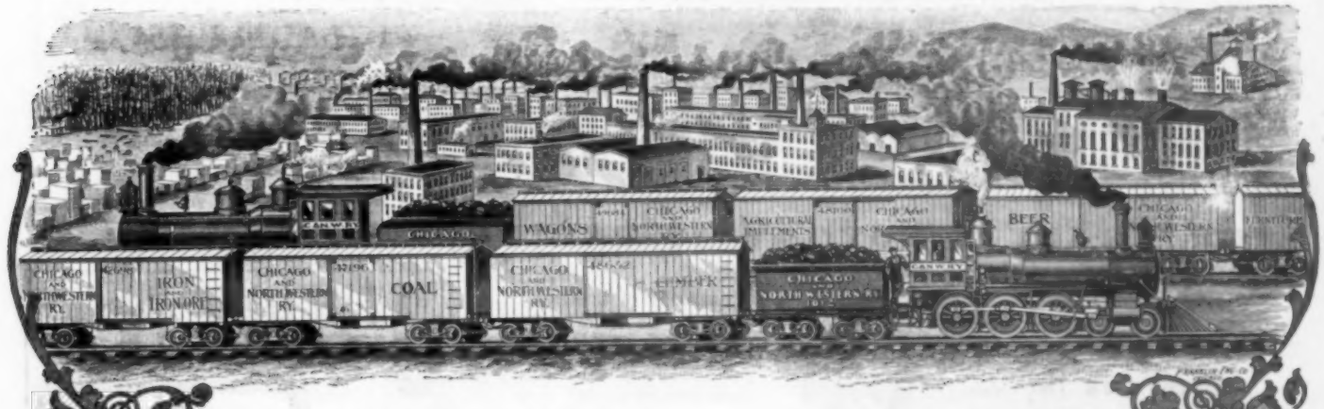
In its annual review of the manufacturing industries of Chicago, the *Tribune* presents the following table, which may be of interest:

Industries.	No.	Capital.	Workers.	Product
Rolling mills	6	$22,000,000	2,800	$14,250,000
Foundries	70	13,000,000	3,750	14,000,000
Machinery, malleable iron, etc	80	6,250 000	2,900	10.000,000
Boiler works	28	700,000	375	1,000,000
Car wheel works	6	3,000,000	1,500	3,000,000
Stoves and furnaces	10	600,000	475	600,000
Steam fitting and heating	22	1,257,000	900	2,500,000
Galvanized iron, tin and roofing	75	800 000	1,000	1,750,000
Barbed wire and wire works	10	400,000	275	675,000
Miscellaneous	60	4,250,000	3.000	6,500,000
Totals	367	$52,250,000	16,975	$54.275,000
Totals for 1895	377	54,650,000	20,150	62,950,000

The amount of wages paid approximated $9,300,000 against $12,000,000 in 1895.

Other lines than iron and steel, according to the *Tribune's* figures, have shown approximately the same decrease in business as above.

THE American Pig Iron Storage Warrant Co. had in yards Dec. 31, 200,700 tons of iron, 2,700 tons having been added and 800 tons withdrawn between Dec. 20 and Dec. 31.



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Manufacturers contemplating moving or establishing branch factories in the West are requested to inquire what we can offer them before locating elsewhere.

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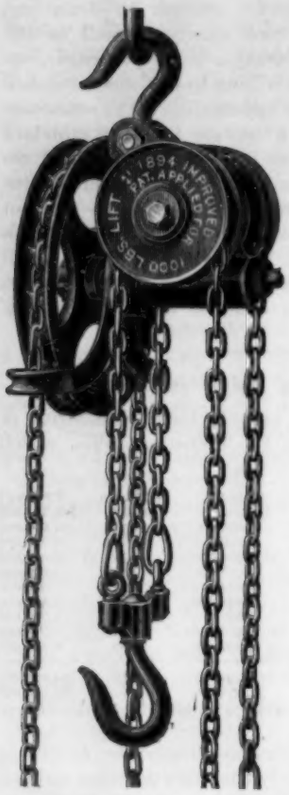

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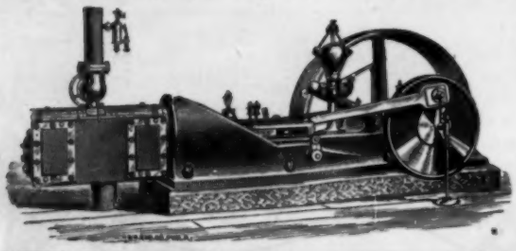

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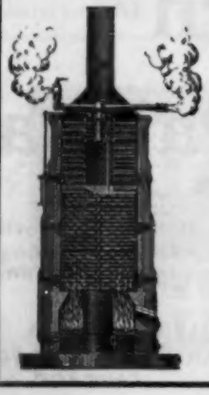

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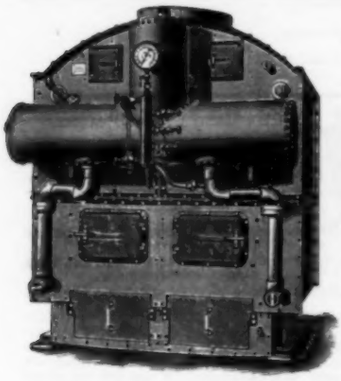

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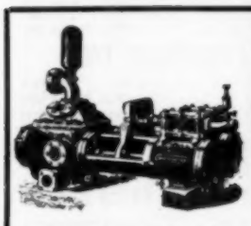

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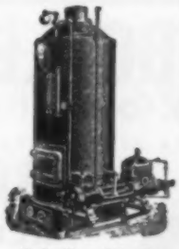

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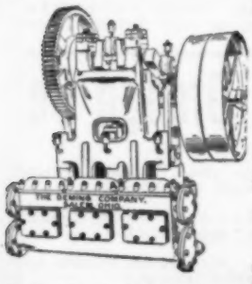

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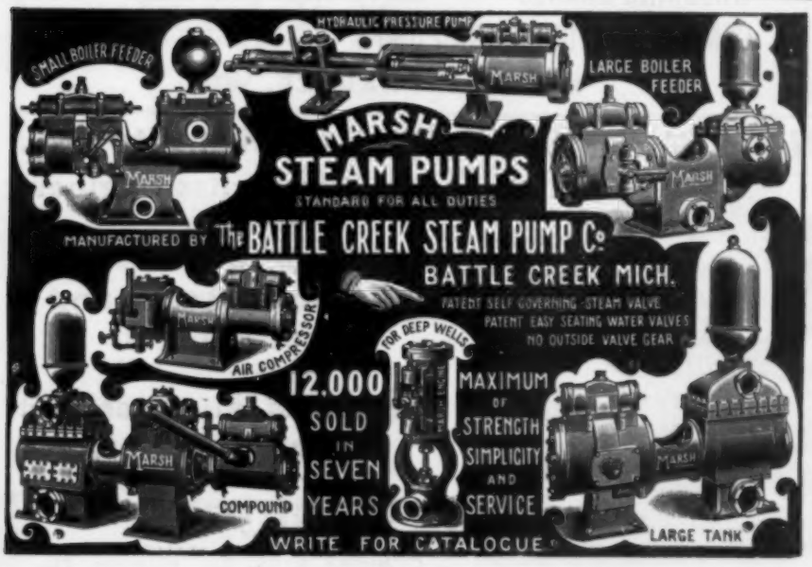

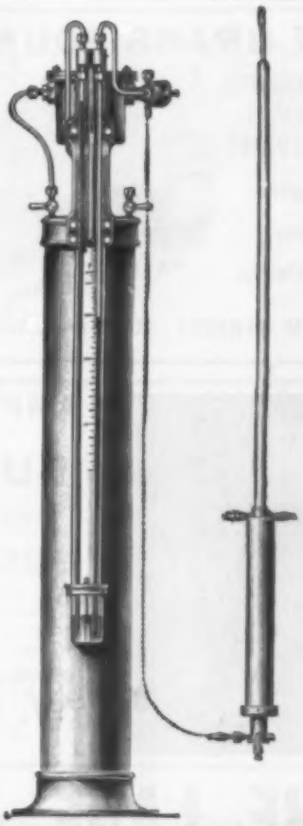

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Baltimore and Washington	* 1:40 pm	*11:25 am
Alliance and Pittsburgh	* 1:40 pm	*11:25 am
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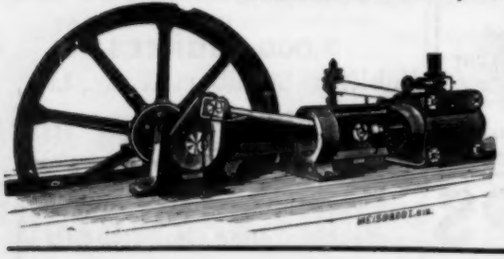

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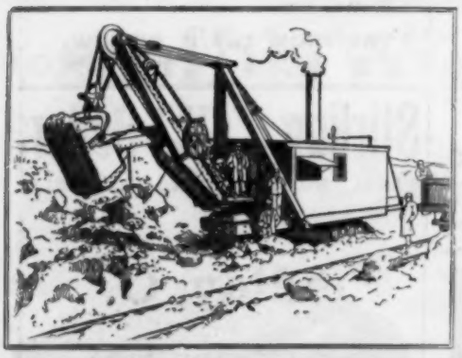

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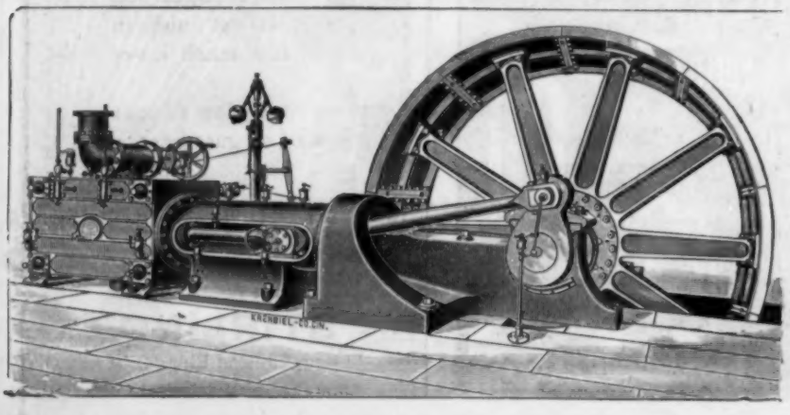

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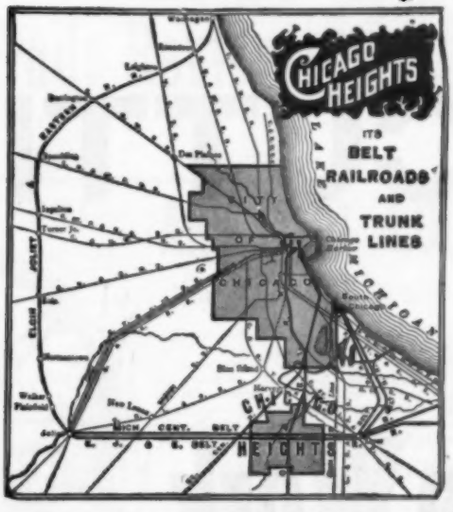

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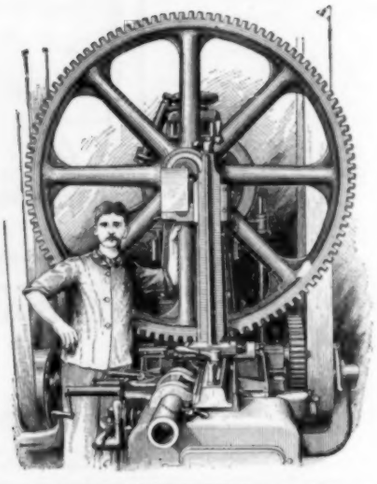

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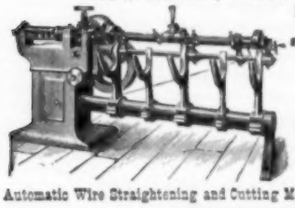

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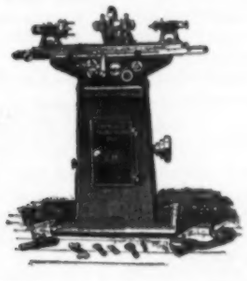

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C. H. Besly & Co., Chicago, Ill.
Diamond Machine Co., Providence, R. I.

Oil Extractors—
Hine & Robertson Co., New York.

Oil Pumps—
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Ore Crushers—
The Edward P. Allis Co., Milwaukee, Wis.

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Jenkins Bros., New York City.
Hine & Robertson Co., New York.

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Jos. Dixon Crucible Co., Jersey City, N. J.

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Canton Leather Fillet Co., Canton, O.

Pattern Works—
Gobeille Pattern Co., Cleveland, O.

Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill
Aitchison Perforated Metal Co., Chicago.

Phosphor Bronze Castings—
Nolte Brass Co., Springfield, O.

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Pipe Covering—
C. H. Besly & Co., Chicago, Ill.

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Enterprise Boiler Co., Youngstown, O.

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Polishing Machines—
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Cady Mfg. Co., Cleveland, O.
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B. F. Sturtevant Co., Boston, Mass.

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Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.

Pulleys—
W. A. Jones Foundry Co., Chicago, Ill.

Pumps (Steam)—
Battle Creek Steam Pump Co., Battle Creek, Mich.
Deming Co., Salem, O.
The Edward P. Allis Co., Milwaukee, Wis.
Atwood & M'Caffrey, Pittsburg, Pa.
Henry R. Worthington, Brooklyn, N. Y.
Hughes Steam Pump Co., Cleveland, O.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

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Dietz, Schumacher & Boye, Cincinnati, O.

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Rand Drill Co., Chicago, Ill.

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Rolling Mill Supplies—
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C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O

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Berger Bros., Philadelphia, Pa.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Cincinnati Corrugating Co. Piqua, O.
Brightman Furnace Co., Cleveland, O.
Playford Stoker Co., Cleveland, O.

Special Machinery—
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Edwin Harrington Son & Co., Philadelphia.

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Translucent Fabric Co., Quincy, Mass.

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Cady Mfg. Co., Cleveland, O.

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Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

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C. H. Besly & Co., Chicago Ill

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C. H. Besly & Co., Chicago, Ill.

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Bucyrus Steam Shovel & Dredge Co., Bucyrus, O
Marion Steam Shovel Co., Marion, O.

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Hine & Robertson Co., New York.

Steam Specialties—
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Bethlehem Iron Co., South Bethlehem, Pa.
Cambria Iron Co., Johnstown, Pa.

Steel Stamps and Stencils—
J. H. Ficharty & Co., Cleveland.

Steel Shafting—
Finished Steel Co., Youngstown, O

Steel Tanks—
Berlin Iron Bridge Co., East Berlin, Conn.

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Playford Stoker Co., Cleveland, O.
American Smokeless Furnace Co., Cleveland, O.
Brightman Furnace Co., Cleveland, O.

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Central Iron & Steel Co., Brazil, Ind.

Tanks—
S. Freeman & Sons Mfg. Co., Racine, Wis.
Enterprise Boiler Co., Youngstown, O.

Tinning Machinery—
The Lloyd-Booth Co., Youngstown, O.

Tin Plate—
Atlanta Steel & Tin Plate Co., Atlanta, Ind.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
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Tools—
L. S. Starrett Co., Athol, Mass.

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C. H. Besly & Co., Chicago, Ill.

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Valves—
C. H. Besly & Co., Chicago, Ill.
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Buffalo Forge Co., Buffalo, N. Y.
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American Hoist & Derrick Co., St.

Wire Machinery—
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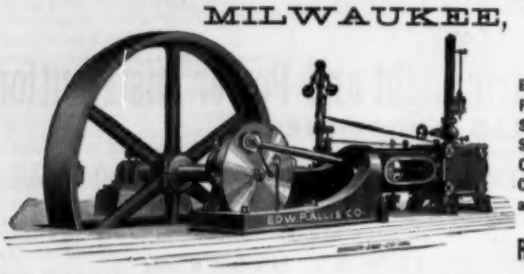

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Blowing Engines, Hoisting Engines, Pumping Engines, Air Compressors, Special Engines for Electric Lighting Street Railways and Rolling Mills, Ore Crushers, Crushing Rolls, Stamp Mills, Concentrators, General Mining, Milling and Smelting Machinery.

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ARTISTIC
PRINTING
WRITE
THE
CLEVELAND
PRINTING &
PUBLISHING CO.,
CLEVELAND, O.

IRON AND STEEL MARKETS.

IRON ORE.

[On Lake Erie docks.]

No. 1 Specular, Bessemer	$4.50@4.75
No. 1 Bessemer hematite	4.00@4.25
Hematites No. 1 non-Bessemer	2.25@2.50
No 1. Specular, non-Bessemer	2.75@3.00

PIG IRON.

CLEVELAND (f. o. b. cars):

Bessemer	$11 00@11 25
No. 1 Strong Foundry	11 65@11 90
No. 2 Strong Foundry	11 25@11 40
No. 1 Gray Forge, red short	9 65@9 90
No. 2 Gray Forge, neutral	9 90@10 15
No. 1 American Scotch	11 90
No. 2 American Scotch	11 40
Lake Superior Charcoal	13 50

PITTSBURG:

No. 1 Foundry	$11 50@12 00
No. 2 Foundry	11 00@11 25
Gray Forge	9 65@9 75
White and Mottled	9 50
Warm Blast Charcoal	15 00@16 00
Cold Blast Charcoal	20 00
Bessemer	10 75@10 90

CHICAGO:

Lake Superior Charcoal	$13 50@$14 00
Local Coke Foundry No. 1	11 75@12 25
Local Coke Foundry No. 2	11 25@11 75
Local Coke Foundry No. 3	11 00@11 25
Local Scotch Foundry No. 1	11 75@12 25
Local Scotch Foundry No. 2	11 25@11 75
Local Scotch Foundry No. 3	11 00@11 25
Southern Coke No. 1	11 65@11 90
Southern Coke No. 2	11 15@11 40
Southern Coke No. 3	10 90@11 40
Southern No. 1 Soft	11 40@11 65
Southern No. 2 Soft	10 90@11 40
Southern Silveries No. 1	12 15@12 65
Southern Silveries No. 2	11 65@12 15
Jackson Co. Silveries	14 00@16 05
Ohio Silveries No. 1	15 00@15 55
Ohio Silveries No. 2	14 50@15 05
Ohio Strong Softeners	14 00@14 28
Alabama Car Wheel	16 65@17 15
Malleable Bessemer	12 75@13 50
Coke Bessemer	13 00@13 50

CINCINNATI (reported by Rogers, Brown & Co.)

Southern Coke No. 1, Foundry	$10 75@11 00
Southern Coke No. 2 and No. 1 Soft	10 25@10 50
Hanging Rock Coke, No 1	12 50@13 50
Hanging Rock Charcoal No. 1, Fdy	15 00@16 00
Tennessee Charcoal No 1	13 00@13 25
Jackson County Silvery No 1	13 50@14 00
Southern Coke, Gray Forge	9 25
" " Mottled	9 25
Standard Alabama Car Wheel	14 75@15 50
Tennessee " "	13 50@14 50
Lake Superior " "	14 75@15 25

BUFFALO:

No. 1 Foundry Strong Coke Iron Lake Superior Ore	$12 25@12 50
No. 2 Foundry Strong Coke Iron Lake Superior Ore	11 75@12 00
Ohio Strong Softener No. 1	12 35@12 60
Jackson Co. Silvery No. 1	14 25@15 25
Lake Superior Charcoal	13 50@14 50
Southern Soft No. 1	12 25@11 40
Hanging Rock Charcoal	17 00

ST. LOUIS (reported by Rogers, Brown & Meacham):

Southern Coke No 1	$11 50
Southern Coke No. 2	11 00
Southern Coke No. 3	10 50
Southern Gray Forge	10 25
Southern Charcoal No. 1	15 00
Missouri Charcoal No. 1	14 00@14 00
Ohio Softeners	15 00
Lake Superior Car Wheel	15 25
Southern Car Wheel	15 75

OLD RAILS AND SCRAP METAL.

[Delivered Cleveland.]	GROSS TONS
Old iron rails	$14 50
Old steel rails	11 00
Old car wheels	11 00
	NET TONS
No. 1 R. R. wrought scrap	$11 00
Mill scrap	8 00
No. 1 Machine cast scrap	8 50
Iron axles	15 00
Axle turnings	8 00
Wrought turnings (free from cast)	7 50
Cast borings	5 00
Uncut wrought iron boilers	4 00
Steel boiler plates	8 00
Grate bars	5 00
Pipes and flues (clean)	8 00
Tank iron	8 00
Hoop and band iron	6 00
Sheet iron	5 00
Wrought drillings	6 00
Malleable iron	9 00

STRUCTURAL MATERIAL.

Beams and Channels (f. o. b. Cleveland)	1.65¢
Angles	1.25¢
Tees	1.35¢
Universal Plates	1.20@1.25¢
Sheared Plates	1.30¢

MERCHANT IRON AND STEEL.

[Less than car-lots, Cleveland.]

Rounds and Squares.—Bar Iron.

1 to 1⅞	1.30 Base
2 to 2½	.20 extra
3 to 3½	.50 "
3⅝ to 4	.80 "
4⅛ to 4½	1.00 "
4⅝ to 5	1.30 "
5⅛ to 6	1.80 "
6⅛ to 6½	2.20

PERFORATED METALS

OF ALL KINDS FOR

MILLING, MINING AND AGRICULTURAL MACHINERY.

Perforated Iron, Steel, Copper, Brass, Tin, Zinc, Lead, Etc., to Order.
Large and Varied Assortment of Sizes. Correspondence Solicited.

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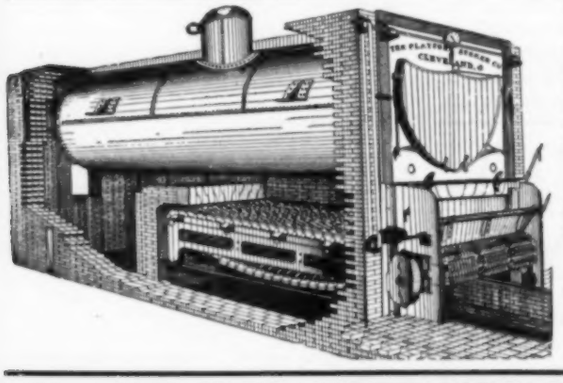
WESTMORELAND FIRE BRICK CO. MANUFACTURERS OF HIGH GRADE FIRE BRICKS.

PITTSBURG, PA.

Works and Mines, Westmoreland, Pa.



The Playford Mechanical Stoker

Guaranteed to

Abolish smoke, to increase boiler capacity and to save fuel.

For information, address,

The Playford Stoker Co.,

No. 61 Case Library Bldg.,

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THE BROWN HOISTING AND CONVEYING MACHINE CO. CLEVELAND, O.

MACHINERY FOR HANDLING COAL AND ORE.

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NEW YORK, HAVEMEYER BLDG. PITTSBURG, CARNEGIE BLDG. CHICAGO, MARQUETTE BLDG.

DIXON'S GRAPHITE PAINT

FOR TIN OR SHINGLE ROOFS AND IRON WORK. IT IS ABSOLUTELY WITHOUT AN EQUAL.

Tin roofs well painted have not required repainting for 10 to 15 years.

If you need any paint it will pay you to send for circular.

JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.

The Iron Trade Review

Pays special attention to iron ore, blast furnace, rolling mill, foundry and machine shop interests. Per year **$3.00.**

IRON CLAD PAINT CO.

Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g.

CLEVELAND OHIO.

ORDER DIRECT FROM THE

Iron Clad Paint Co.

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.

FURNISHED both Dry and Ground in Oil

USED BY NEARLY ALL THE RAILROADS.

6⅝ to 7¼	2.50 extra.
¾ to ⅞	.10 "
⅝ to 11-16	.20 "
½ to 9-16	.30 "
7-16 to 15-32	.40 "
⅜ to 13-32	.50 "
5-16 to 11-32	.70 "
¼ to 9-32	.90 "
7-32	1.40 "
3-16	2.50 "

Flats.—Bar Iron.

1½ to 4 x ⅜ to 1	1.20 Base.
4¼ to 6 x ⅜ to 1	.10 extra.
6¼ to 8 x ⅜ to 1	.60 "
8¼ to 10 x ⅜ to 1	.80 "
1⅜ to 4 x 1 1-16 to 1½	.30 "
4¼ to 6 x 1 1-16 to 1½	.40 "
6¼ to 8 x 1 1-16 to 1½	.60 "
8¼ to 10 x 1 1-16 to 1½	.90 "
2 to 4 x 1⅝ to 2	.50 "
4¼ to 6 x 1⅝ to 2	.60 "
6¼ to 8 x 1⅝ to 2	.80 "
8¼ to 10 x 1⅝ to 2	1.00 "
2 to 4 x 2⅛ to 3	.60 "
4¼ to 6 x 2⅛ to 3	.80 "
6¼ to 8 x 2⅛ to 3	1.00 "
1⅛ to 1⅜ x ⅛ to 1	.10 "
1 to 1 1-16 x ⅜ to ⅝	.20 "
¾ to 15-16 x ⅜ to ¼	.40 "
⅝ to 11-16 x ⅜ to ⅝	.50 "
½ to 9-16 x ⅜ to ½	.90 "

Heavy Band Iron.

7 to 10 x ¼ to 5-16	.70 extra.
6¼ to 6¾ x ¼ to 5-16	.50 "
4⅝ to 6 x ¼ to 5-16	.30 "
1½ to 4 x ¼ to 5-16	.20 "
1 to 1⅜ x ¼ to 5-16	.30 "
¾ to 15-16 x ¼ to 5-16	.50 "
⅝ to 11-16 x ¼ to 5-16	.80 "
⅛ to 9-16 x ¼ to 5-16	1.00 "
⅜ to 7-16 x ¼ to 5-16	1.50 "

Heavy bands, 7-32 in. thick 1-10 c. per lb. higher than ¼ to 5 16 thick. **Bevel Edge Shaft Iron** 1-10 higher than same size of Heavy Bands.

Light Band Iron.

7 to 8 x No 9 to 3-16	.90 extra.
7 to 8 x Nos. 10, 11 and 12	1.00 "
6¼ to 6¾ x No. 9 to 3-16	.70 "
6¼ to 6¾ x Nos. 10, 11 and 12	.80 "
4½ to 6 x No. 9 to 3-16	.50 "
¼ to 6 x Nos. 10, 11 and 12	.60 "
1¼ to 4 x No. 9 to 3-16	.40 "
1¼ to 4 x Nos. 10, 11 and 12	.50 "
1 to 1 3-16 x No. 9 to 3-16	.50 "
1 to 1 3-16 x Nos. 10, 11 and 12	.60 "
13-16 to ⅞ x No. 9 to 3-16	60 "
13-16 to ⅞ x Nos. 10, 11 and 12	.70 "
11-16 to ¾ x No. 9 to 3-16	.80 "
11-16 to ¾ x Nos. 10 11 and 12	.90 "
9-16 to ⅝ x No. 9 to 3-16	1.00 "
9-16 to ⅝ x Nos 10, 11 and 12	1.10 "
7-16 to ½ x No 9 to 3-16	1 30 "
7-16 to ½ x Nos 10, 11 and 12	1 40 "
⅜ x No. 9 to 3-16	1.50 "
⅜ x Nos. 10, 11 and 12	1.60 "

Bevel Edge Box Iron.

Same as Light Bands, of same sizes.

Beaded Band Iron, 1¾ in. to 2 in. .70

Sand Band Iron, 1-10 c. above same sizes of Light Bands.

Oval Iron.

⅜ to 1⅝	.40 extra.
¾ to 13-16	.50 "
⅝ to 11-16	.60 "
½ to 9-16	.80 "
⅜ to 7-16	1.10 "
¼ to 9-16 x 3-16	1.00 "
⅜ to 11-16 x ¼	1.20 "

Half Oval and Half Round.

2¼ to 3	.60 extra.
⅞ to 2	.50 "
¾ to 13-16	.70 "
⅝ to 11-16	90 "
½ d 9-16	1.20 "
⅜ to 7-16	2 50 "
5-16	3.50 "
¼	4 50 "

Half Ovals less than ¼ their width in thickness, extra price.

Horse Shoe Iron.

All sizes 1 c extra.

Cutting ordinary bars to specified length, 20 to .30 extra, according to length and size.

Steel Bands.

Width In Inches.	English Standard Gauge.	
1 1-2 to 6,	Nos. 7, 8, 9 or 3-16"	1.50 Base. Extras.
1⅜ to 6,	" 10, 11, 12 or ¼"	.05 per 100 lbs.
1 to 1⅜,	" 7, 8, 9 or 3-16"	.10 "
1 to 1⅜,	" 10, 11, 12 or ¼"	.15 "
13-16 and ⅞,	" 7, 8, 9 or 3-16"	.20 "
13-16 and ⅞,	" 10, 11, 12 or ¼"	.25 "
11-16 and ¾,	" 7, 8, 9 or 3-16"	.30 "
11-16 and ¾,	" 10 11, 12 or ¼"	.35 "
9-16 and ⅝,	" 7, 8, 9 or 3-16"	.40 "
9-16 and ⅝,	" 10 11, 12 or ¼"	.45 "
½	Nos. 7 8 9 or 3-16"	.55 "
½,	" 10, 11, 12 or ¼"	.60 "
7-16	" 7, 8, 9 or 3-16"	.75 "
7-19	" 10, 11, 12 or ¼"	.85 "
⅜,	" 7, 8, 9 or 3-16"	.95 "
⅜,	" 10, 11, 12 or ¼"	1.05 "

Iron and Steel Hoops.

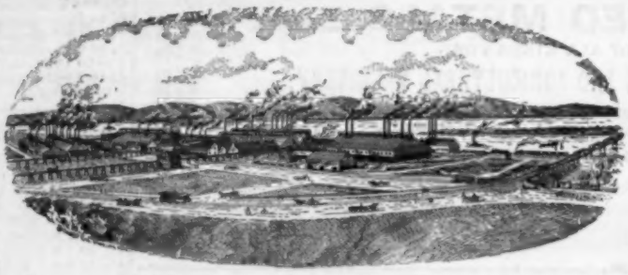
Width in Inches.	English Standard Gauge.	
1 7-16 to 3	Nos. 13, 14, 15 and 16	1 60 Base. Extras
1 7-16 to 3,	" 17, 18, and 19	.05 per 100 lbs.
1 7-16 to 2,	" 20	.10 "
1 7-16 to 2,	" 21	.15 "
1 7-16 to 1¾,	" 22	.25 "
1 ⅝ to 1¾,	" 13, 14 and 15	.05 "
1⅝ to 1¾,	" 16, 17 and 18	.10 "

Soft Steel Bars, Light

LOW PRICES

do not always influence business. Some brands of goods are undesirable as a **Gift.**

Write us for our catalogue and send us a sample order and see if there is not **Economy** in using **First Quality** goods at Fair Prices.



Structural Shapes, Rails.

TIN PLATES,
GALVANIZED SHEETS,
CORRUGATED IRON,
BLACK PLATES,

Sheet Iron and Steel, any finish, patent leveled or common.

Aetna Standard Iron & Steel Co.,
BRIDGEPORT, OHIO.

W. H. COFFMAN COKE CO.

BLUEFIELD, W. VA.

GENERAL FACTORS AND SHIPPERS OF

POCAHONTAS FLAT-TOP COKE.

So low in ash that it requires no fluxing for foundry purposes. Our foundry and furnace coke was awarded the first premium at the World's Fair in 1893.

AVERAGE ANALYSIS OF COKE.

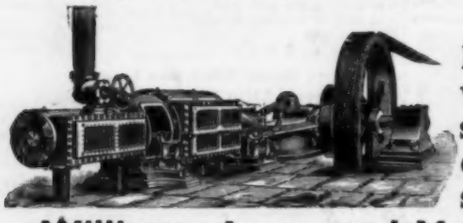
Moisture	00.196	Sulphur	00.677
Fixed Carbon	93.625	Ash	05.004
Volatile Matter	00 494		

Foundry, Furnace and all sizes of crushed coke. Guaranteed lower in Sulphur than any other commercial coke

WILLIAM TOD & CO.

YOUNGSTOWN, OHIO.

The Porter-Hamilton Engine



Reversing Engines, Blowing Engines, Converters, Hydraulic and special heavy machinery for the iron and steel trades.

Williams Improved Vertical Engines

For Direct Electrical and all High Class Work.

39-41 Cortland St., N. Y. — E. F. WILLIAMS.

Park Building, Pittsburg, — SEWARD S. BABBITT.

THE 1896 EDITION

OF THE

Iron and Steel Directory

Will be sent postpaid by *The Iron Trade Review* at **$6.**

Is a thorough revision of the list of blast furnaces, rolling mills, Bessemer and Open-Hearth steel works, plate and sheet mills, nail mills, tin plate mills, malleable, cast iron pipe and wrought pipe works, car wheel and locomotive works.

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SKYLIGHTS LEAK?

Then send for our catalogue. It will tell you how to repair them so they will never leak.

Translucent Fabric Skylights are now in use in all parts of the United States, and are giving the best satisfaction. Why? Because they never crack, break or leak, cost nothing for repair work and are inexpensive to build.

TRANSLUCENT FABRIC CO., QUINCY, MASS.

1⅛ to 1⅜,	"	19 and 20	.15 per 100 lbs.
1⅛ to 1⅜,	"	21	.20 "
1⅛ to 1⅜,	"	22	.30 "
15-16 and 1,	"	13, 14 and 15	.10 "
15-16 and 1	"	16, 17 and 18	.15 "
15 16 and 1,	"	19 and 20	.20 "
15-16 and 1,	"	21	.25 "
15-16 and 1,	"	22	.35 "
⅞, Nos.	13, 14 and 15		.20 "
⅞, "	16, 17 and 18		.25 "
⅞, "	19 and 20		.30 "
⅞, "	21		.35 "
⅞, "	22		.45 "
¾ and 13-16 Nos.	13, 14 and 15		.30 "
¾ and 13-16 "	16, 17 and 18		.35 "
¾ and 13-16 "	19 and 20		.40 "
¾ and 13-16 "	21		.45 "
¾ and 13-16 "	22		.50 "
¾ and 13-16 "	23		.60 "
11-16, Nos.	13, 14 and 15		.35 "
11-16, "	16, 17 and 18		.40 "
11-16, "	19 and 20		.50 "
11-16, "	21		.60 "
11-16, "	22		.70 "
11-16, "	23		.80 "
⅝, Nos.	13, 14 and 15		.40 "
⅝, "	16, 17 and 18		.45 "
⅝, "	19 and 20		.55 "
⅝, "	21		.65 "
⅝, "	22		.75 "
⅝, "	23		.85 "
9 16, "	13, 14 and 15		.45 "
9-16, "	16, 17 and 18		.50 "
9-16, "	19 and 20		.60 "
9-16, "	21		.70 "
9-16, "	22		.80 "
9-16, "	23		.90 "
½, "	13, 14 and 15		.55 "
½, "	16, 17 and 18		.60 "
½, "	19 and 20		.70 "
½, "	21		.80 "
½, "	22		.90 "
½, "	23		1.00 "
7-16, "	13, 14 and 15		.80 "
7-16, "	16, 17 and 18		.90 "
7-16, "	19 and 20		1.00 "
⅜, "	13, 14 and 15		1.00 "
⅜, "	16, 17 and 18		1.10 "
⅜, "	19 and 20		1.20 "

Sheet Iron.

No. 10	1 50
No. 12	1 70
No. 14	1 60
No. 15-17	1 75
No. 18	1 85
No. 20	2 00
No. 22-24	2 10
No. 25-26	2 20
No. 27	2 30

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 35
Shell	1 45
Flange	1 55
Marine Flange	1 60
Fire Box	2 05

Above includes plates 90 inches wide.

90 to 96 in. wide	⅛c. lb. extra
96 to 100 in. wide	1c. "
100 to 104 in. wide	1⅛c. "
104 to 106 in. wide	special.

American Cast Tool Steel.

ROUND, SQUARE, AND OCTAGON.	cts lbs.
1 to 2 in. inclusive	08
9-16 to ½ in. "	08
7-16 to ⅜ and 2⅜ to 3 in.	09
3⅛ to 4 in	09½
⅝ to 11-16 and 4⅛	10
⅛ to 6 in	10½
¼ to 9-32 and 6⅛ to 7 in	11
1 in	13

Flats.	cts. lbs.
2 to 9-16 in. wide by 2 to ⅛ thick	08

Bessemer and O. H. Steel.

Bessemer Machinery	base price,	1 40
Open-hearth Tire	"	1 45
Open-hearth Spring	"	1 80
Sleigh Shoe	"	1 45
Toe Calk	"	1 90
Cutter Shoes, tapered and bent	"	2 60

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 00
Bridge ½, ⅝, 11-16 and ¾ inch diam	2 55

Wrought Pipe and Boiler Tubes.

Lap weld	black	base,	four 10s	62
Butt "	"	"	four 10s	62½
Lap "	galv.	"	four 10s	52½
Butt "	"	"	four 10s	50
Boiler tubes 2¼" and smaller				70
Boiler tubes 2½" and larger				75
Casting screw and socket joint				dis. 52½
Casing inserted joint				dis. 47½

SHIFFLER BRIDGE COMPANY,

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SPECIALTIES: STEEL AND IRON BUILDINGS FOR ROLLING-MILLS TIN PLATE PLANTS, STEEL WORKS, FOUNDRIES, FACTORIES, ROOF TRUSSES, GIRDERS, COLUMNS, BEAMS, CORRUGATED IRON, ETC.

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PITTSBURG, PA.

Branch Offices:
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65 Dexter Building, Chicago, Ill.
228 Lumber Exchange, Minneapolis, Minn.

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Steel Rails, Blooms, Billets, Beams, Bars, Axles, Angles, Channels, Castings, Forgings, Zee Bars, Car-Channels, Locomotive, Car and Structural Steels, etc.

CAMBRIA IRON COMPANY, S. W. Cor. 15th and Market Sts., opp. Penna. R. R. Station, Philadelphia; Chicago office, Western Union Building; New York office, (for Rails and Axles), 33 Wall St.; Cleveland office, Bourne, Fuller & Co; Detroit office, Newberry Bldg.; Toledo office, The Nasby, No. 401; Cincinnati office, cor. Elm and Pearl Sts. Works at Johnstown, Pa.

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JOHNSTOWN, PA.

MERCHANT BAR STEEL: Including Tire, Toe Calk, Machinery, Carriage Spring, Railroad Spring, Hoe, Rake, Fork, etc.
AGRICULTURAL STEEL AND SHAPES: Finger Bars, Knife Backs, Rake Teeth, Bundle Carrier Teeth, Tedder Forks and Springs, Spring Harrow Teeth, Harrow (Drag) Teeth, Seat Springs, etc.
PLOW STEEL: Flat and Finished Plow Shapes, Digger Blades, Slabs (Penn and Pernot), Hammered Lay, Rolled Lay, etc.

Cold Rolled Steel Shafting. **Steel Harrow Discs.** **Cambria Link Barb Wire.**

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For Open-Hearth, Basic and Acid Steel Furnaces, Glass and Copper Tank Furnaces. Extra Shapes MADE TO ORDER.
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We are the only Steel Roofing Co. awarded Medal and Diploma for **PATENT CAP ROOFING** at World's Columbian Exposition. We are also large manufacturers of all styles of METAL ROOFING, SIDING, CEILING, ETC. Send for Catalogue and Price List. Mention this paper.
SYKES IRON & STEEL ROOFING CO., • Chicago and Niles, O.

MACHINERY SUPPLY MARKET.

[From Store, Cleveland.]

Anvils.

American	₩ lb 9@10
Wright's	₩ lb 12

Bellows.

Blacksmiths' { Hill's	dis 40
Blacksmiths' { Bullock's	dis 50&10
Moulders'	dis 40@40&10
Hand	dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70 & 10
" " " extra	dis 60&10
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 50
Shults Raw Hide Leather Belting, single,	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 50&10
Shults Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.,	dis 35

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 80
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis 33⅓
Horton's Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 45
Sweetland "	dis 40
Almond Drill	dis 40
Morse "	dis 20
Skinner's Combination Lathe	dis 40&15
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 30

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Morse	dis 10 to 15
Brown & Sharpe, Milling Cutters	dis 15
" " Gear Cutters	dis 15

Crowbars.

Cast Steel	₩ 3½
Iron, steel points	₩ lb 3

Drill and Drill Sockets.

Twist Drills	
Morse Taper & Straight Shank to 1½"	dis 50 &10 to 60
Morse Taper and Straight Shank Larger than 1½"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 60@60&5
Cleveland " "	dis 60@60&5

Emery.

	No. 4 to 46 gr.	No. 54 to 150 gr.	Flour, F. F
Kegs, ₩ lb	4½c	5 c	2½c
½ kegs ₩ lb	4¾c	5¾c	2¾c
¼ kegs ₩ lb	5 c	5½c	3 c
10 lb cans, 10 in case	6 c	6½c	5 c
10 lb cans less than 10	10 c	10 c	7½c

Emery Cloth and Paper.

Barder, Adamson & Co.	dis 50@50&5
H. H. Barton	dis 50@50&5

Emery Wheels.

Detroit	dis 60@70
Norton's	dis 60@70
Grant	dis 60@70
Sterling	dis 60@70
Celluloid	dis 10&33⅓
Northampton	dis 50
Crystal	dis 65@70
Vitrified	dis 60@70
Vulcanite	dis 60&10
Hamden	dis 60&10@70
Cyclone	dis 60@60&10

Files.

Arcade	dis 60&10@60&10&10
Nicholson	dis 60&10@60&10&10
" X. F	dis 25
Kearney & Foot	dis 60&10@60&10&10
Black Diamond	dis 60&10@60&10&10
McClellan	dis 60&10@60&10&10
Disston's	dis 65@70
Western	dis 70
Stub's	dis 25
Grobet's	dis 30
Reynolds Bros.' Hand Cut	dis 50
Industry File Works Hand Cut	dis 50

Hammers.

P. S. W	dis 40
Atha new list, Jan. 15, 1897	dis 50
Heavy hammers and sledges under 5 lbs	10c
" " " " over 5 lbs	8c

Jack Screws.

Illinois Bolt Co. list	dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	⅞	1
Square	8	7	5½	4½	4	3½	3⅛	
Hexagon	15¼	11¼	8½	6	5¼	5¼		
Washers	9	8	7	5	4⅜	4⅜	4⅛	

In lots less than 100 lbs, ₩ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire).

Standard Penny Nails, ₩ keg, base.

{ Car lots	$1.50
{ Less than car lots	$1.60

Catalogue and Prices on Application.

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz.....dis 10@10&10

Picks.

Railroads, 5 to 6 lbs.....$12 dis 60
" 6 to 7 lbs.....$13 dis 60

Pulleys.

Iron Pulleys, Walker List.....dis 50
Medart Pulleys.....dis 50
Split Wood Pulleys.....dis 55@60

Pulley Blocks.

Moore's Anti-Friction Differential Chain Pulley Block.....dis 20

Rivets.

Iron, Thousand, list November 1, 1894.....dis 60@65
Iron, Ordinary, Cooper's Block and Carriage list November 1, 1894.....dis 60@65
Copper.....dis 50@50&10

Taps.

Cards, Hand and Nut to 2 in.....dis 50
Carpenters' " " " .....dis 50
Morse " " " .....dis 50
Pratt & Whitney " " new list.....dis 10
Machine Screw Taps.....dis 55
Pipe Taps to 2½ in.....dis 70
Stay Bolt Taps.....dis 25
Stove Bolt Taps.....dis 55
Pulley Taps.....dis 40

Vises.

Solid Box.....dis 60
Parker's.....dis 20@25
Prentiss.....dis 20
Stephen's.....dis 25@30
Barrett's.....dis 30
Miller's Falls.....dis 40
Merrill's.....dis 15@20
Howard.....dis 35

Wire.

New List, Apr. 9, 1894

Brass.....dis 35
Copper.....dis 35
Bright and annealed, Nos. 0@18.....dis 70&10@75
" " Nos. 19@26.....dis 75@75& 5
" " Nos. 27@36.....dis 75&10& 5
Coppered Nos. 0 to 18, market list.....dis 70@70& 5
Galvanized Nos. 0 to 18 " " .....dis65& 5
Tinned market Nos. 0 to 18.....dis 67½
Cast steel.....dis 50
Tinned Broom Wire.....dis 70&5@70&10
Annealed Fence, Nos. 8 and 9.....dis 75
Annealed Grape, Nos. 10 to 14.....dis 75
Stub's Steel Wire regular.....95c ₩ lb dis 30

Wrenches.

Coe's genuine.....dis 4 and 10
Girard Standard.....dis 70&15
Agricultural.....dis 75&15
Mechanic's.....dis 55&10& 0
Bemis & Call's Combination.....dis 30
Donohue's Engineers.....dis 20&15
Lamson & Sessions Engineers.....dis 65
Billings & Spencer's Drop Forged.....dis 25
William's " " .....dis 25
Alligator " " .....dis 40

The Iron Trade Review has a rapidly growing constituency in the great Central Zone, the best buying section in the country, as machinery manufacturers and establishments devoted to power equipment have found out in the past three years. Between the Alleghenies and the Mississippi are located many of the most prosperous industries in the country, and they have been buyers when there was only limited business in other sections. Advertisers are coming to recognize this fact, as the growing patronage of the columns of this paper gives abundant testimony.

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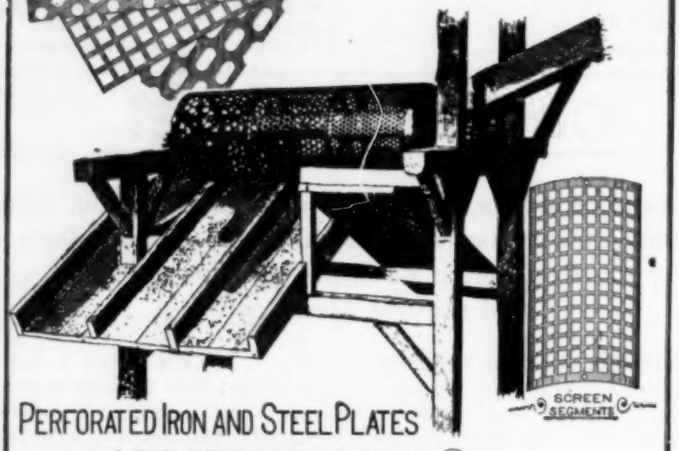
CHICAGO, ILL.



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FOR SCREENING AND SIZING
COAL, COKE, ORE, STONE &C.
BRONZE PLATES TO WITHSTAND THE ACTION OF MINE WATERS.
PLATES FURNISHED FLAT, OR ROLLED TO CYLINDRICAL FORM FOR REVOLVING SCREENS.
PERFORATIONS IN ROUND, SQUARE, OR OBLONG HOLES.
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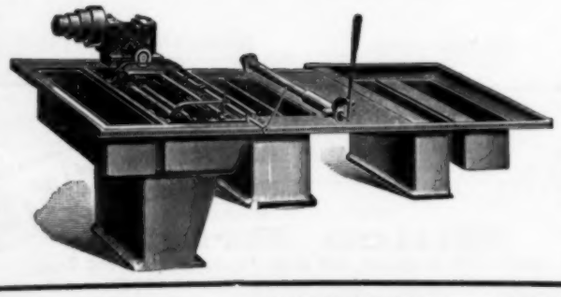

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BILLETS AND MUCK BAR,

STEEL FORGINGS.

HOLLOW SHAFTING, CRANKS, ROLLS, GUNS AND ARMOR.

Rough, Machined or Finished, Fluid Compressed, Hydraulic Forged.

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We manufacture

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Power Presses. Trimming Presses.
Straight Sided Double Pitman Presses.
Drop Presses.
Embossing Presses. Automatic Feed Presses.
Stamping Presses. Power Slitting Machines.
Riveting Machines. Power Shears.

Special and Automatic Machinery Dies for all classes of work in sheet metals.

Write for catalogue and prices.

No. 25 Power Press.

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MANUFACTURED BY

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BESSEMER AND OPEN-HEARTH STEEL,

Blooms, Billets, and Slabs, Steel Rails, Steel Beams, Channels and Angles. Steel Forgings, Bar Spring, and Sleigh Shoe Steel. Steel Wire of all kinds. Barbed Wire, Iron and Steel Plates, Galvanized and Black Sheet Iron and Steel Corrugated Iron Roofing.

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Can be furnished at low cost.

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The Standard Portable Pyrometer—For Blast Furnaces.

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Wrought Iron Open Hexagonal Turnbuckles,

MADE FROM THE BEST CHARCOAL IRON.

Guaranteed Stronger than any Similar Article on the Market.

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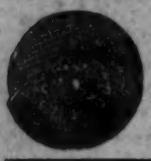

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☞ N. B.—Also Agent of WM. SELLERS & CO.'s SPECIAL TOOL GRINDER and TWIST DRILL GRINDER WITH POINTER, for Pennsylvania, Ohio, Indiana, Illinois and Wisconsin.

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Steel Works, Rolling Mills, Metallurgical Furnaces, Manufacturing Buildings, Machinery for the most economical handling of all kinds of materials.

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For Loose Pulleys and other bearings. Perfectly clean. No cutting or danger of fire from overheating. Send for Loose Pulley circular.

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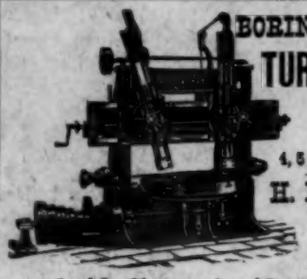

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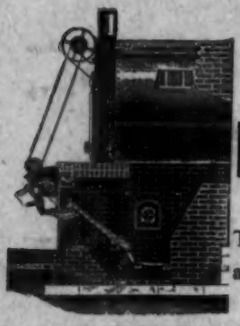
Fire Brick, Fire Clay and Foundry Supplies.

N. W. TAYLOR. H. H. CAMPBELL.



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FOR STEAM BOILERS.

THE MOST ECONOMICAL IN FUEL

and the Best Device in the World for Preventing Smoke.

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The simplest gas and gasoline engine on the market. Has no equal for absolute, steady speed and durability. It is a dwarf in size and a Samson in strength.

Catalogue sent on application.

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